AD-A157 289 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS HAROLD E WATSON RESER..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV APR 79 1/1

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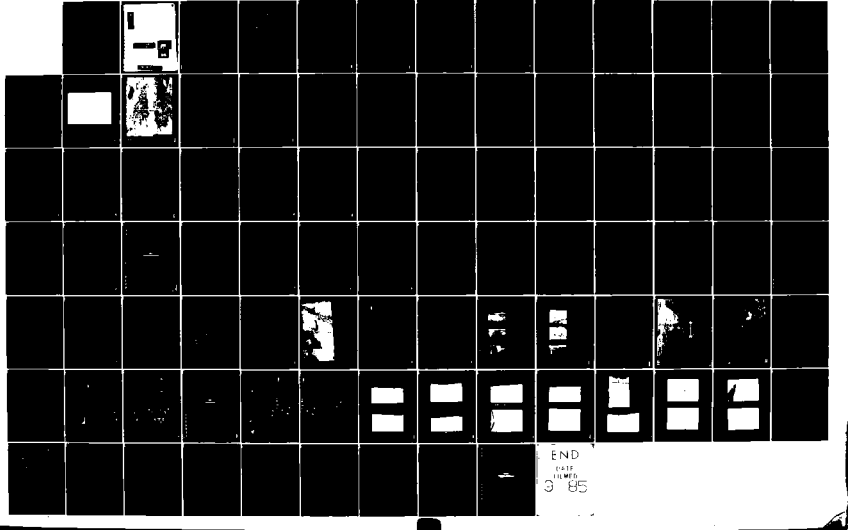

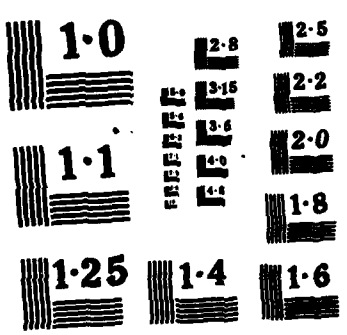
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1. REPORT NUMBER RI 01802	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Harold E, Watson Reservoir Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE April 1979 13. NUMBER OF PAGES 58
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Sakonnet River Basin
Little Compton, RHode Island
Pachet Brook

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is a zoned earth embankment dam which is 760 ft. long and 38 ft. high. The dam is considered to be in good condition. To assure the long term performance of the dam there are several items which require attention. The dam is intermediate in size with a significant hazard potential. Additional remedial measures that should be implemented by the owner within a two year period after receipt of the Phase I inspection report.

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SAKONNET RIVER BASIN

LITTLE COMPTON, RHODE ISLAND

HAROLD E. WATSON RESERVOIR DAM

RI 01802

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

"Original contains color plates: All DTIC reproductions will be in black and white"

NATIONAL DAM INSPECTION PROGRAM

PHASE I - INSPECTION REPORT

Identification No.:	RI 01802
Name of Dam:	Harold E. Watson Reservoir Dam
Town:	Little Compton
County and State:	Newport County, Rhode Island
Stream:	Pachet Brook
Date of Inspection:	16 November 1978

BRIEF ASSESSMENT

The Harold E. Watson Reservoir Dam is a zoned earth embankment constructed in 1960 for the City of Newport, and is operated as a standby surface water supply for the Newport Water Department. The dam is 760 feet long, 38 feet in height, with a top width of 20 feet, and a crest elevation of 53.0. The outlet control structure is located at the approximate center of the embankment on the upstream slope and is constructed of reinforced concrete. Water is withdrawn from the wet well chamber of this structure through a 24-inch diameter concrete pipeline to the system or by-passed downstream to Pachet Brook through a 42-inch diameter outlet pipe. A rectangular drop inlet spillway structure is constructed integrally with the outlet structure. A grassed trapezoidal emergency spillway is located on the right abutment of the dam.

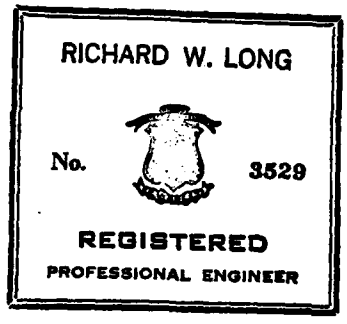
As a result of the visual inspection and the review of limited available data regarding this facility, the dam is considered to be in GOOD condition. To assure the long term performance of this structure, several items of concern require attention. The apparent seepage along the downstream toe of the dam and at the outlet structure should be monitored with the intent of future corrective action.

This dam is classified as INTERMEDIATE in size and a SIGNIFICANT hazard structure in accordance with the recommended guidelines established by the Corps of Engineers. The test flood for this dam is one-half the Probable Maximum Flood (PMF). This test flood has an outflow discharge equal to 620 CFS (167 CSM) and would not overtop the dam. The maximum project spillway discharge capacity (drop inlet plus emergency spillway) of 1428 CFS represents more than 100 percent of the test flood outflow.

Additional remedial measures that should be implemented by the Owner within a two-year period after receipt of this Phase I Inspection Report are described in Section 7.

C-E MAGUIRE, INC.

Richard W. Long, P.E.
Vice President



This Phase I Inspection Report on the Harold E. Watson Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

SAUL C. COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, DC 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or to property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there by any opportunity to detect unsafe conditions.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonable possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in deter-

mining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance and sound engineering judgment.

c. Validity. The validity of the limited data available must be verified.

SECTION 2

ENGINEERING DATA

2.1 Design. The following documents which contain the principal information regarding this design were reviewed in the preparation of this report:

Contract No. 4 - "Pachet Brook Dam" - City of Newport, Rhode Island, Newport Water Works - January, 1959 - As Built.

2.2 Construction. A series of record photographs of the progress of construction are on file at the office of the Newport Water Works. These were reviewed as part of the Phase I Inspection. In addition, limited information about the construction was provided in two field report memos from the resident construction engineer, dated 10/6/60 and 7/29/60. It is assumed that all revisions to the design have been noted and incorporated into the "as built" drawings referenced in Section 2.1.

2.3 Operation. The Newport Water Works maintains records of operation of this facility regarding discharges and water surface levels. The dam and its appurtenances are inspected weekly by local caretakers and operating staff of the water company.

2.4 Evaluation.

a. Availability. The information noted above for this facility is available in the files of the Newport Water Works and the Department of Environmental Management - State of Rhode Island. Additional data may be obtained from the inactive job files of the designers - Malcolm Pernie, Environmental Engineers, White Plains, New York.

b. Adequacy. The lack of in depth engineering data did not allow for a definitive review.

6.	D/S Channel	Discharges drop into the wet well of the outlet works and flow through a 42-inch diameter outlet pipe to Pachet Brook.
7.	General	-----

j. Regulating Outlet

Water levels can be regulated by a 36-inch diameter sluice gate and inlet pipe to the wet well of the outlet works structure. The discharge would then flow through a 42-inch diameter outlet pipe to Pachet Brook.

1.	Intake Invert	Elevation 19.0
2.	Size	36-inch diameter
3.	Description	Reinforced Concrete Pipe
4.	Control Mechanism	36-inch diameter sluice gate
5.	Other	a 24-inch diameter intake water supply pipe also is used to withdraw water from the supply.

		Downstream 2.5H:1V
6.	Zoning	Unknown
7.	Impervious Core	Rolled select material, Material Unknown.
8.	Cutoff	Partial foundation cut-off of Rolled Select Material Select Material Unknown.
9.	Grout Curtain	None
10.	Other	--

h. Diversion and Regulating Tunnel — NA

i. Spillway
Emergency

1.	Type	Trapezoidal, Grassed
2.	Length of Weir Base	Width = ±20.0 ft.
3.	Crest Elevation	48.5
4.	Gates	None
5.	U/S Channel	Natural Bed
6.	D/S Channel	Natural Bed
7.	General	----

Drop Inlet Structure

1.	Type	Drop Inlet
2.	Length of Weir Base	15.0 feet (effective length overflow)
3.	Crest Elevation	45.0
4.	Gates	None
5.	U/S Channel	The drop inlet is constructed as an integral part of the outlet works structure.

e. Storage (Ac.-Ft.)

1.	Water Supply Pool	4,910
2.	Flood Control Pool	N/A
3.	Test Flood Pool	6,785
4.	Spillway Crest Pool	4,910
5.	Top of Dam	7,860

6. Net storage between top of dam and spillway crest is 2946 Ac.-Ft and represents 14.89 inches of runoff from the drainage area of 3.71 square miles.

7. One foot of surcharge storage equals 1.86 inches of runoff from the drainage area of 3.71 square miles.

f. Reservoir Surface (Acres)

1.	Top of Dam	375
2.	Test Flood Pool	--
3.	Flood Control Pool	N/A
4.	Recreation Pool	N/A
5.	Spillway Crest	375

g. Dam

1.	Type	Zoned earth embankment
2.	Length	760 feet
3.	Height	38 feet
4.	Top Width	20 feet
5.	Side Slopes	Upstream Elev. 26 to Elev 53 2.75H:1.0V Elev. 20 to Elev. 26 - 4.0H to 1.0V.

capacity of the 42-inch diameter concrete pipe which is an integral part of the outlet works.

4. Drop inlet spillway capacity at "Test Flood Level" - 373 cfs at Elevation 49.98
   Emergency spillway Capacity at "Test Flood Level" - 247 cfs at Elevation 49.98

5. Total project capacity at "Top of Dam" - 1,428 cfs @ Elevation 53.0

6. Total project discharge at "Test Flood Level" - 620 cfs @ Elevation 49.98

c. Elevations (Feet above National Geodetic Vertical Datum, NGVD)

1. Streambed at centerline of dam -
   Upstream 17.0
   Downstream 15.0

2.	Maximum Tailwater	Unknown
3.	Upstream Inlet Invert	19.0
4.	Recreation Pool	N/A
5.	Full Flood Control Pool	N/A
6.	Spillway Crest	45.0
7.	Maximum Flow Line	47.6
8.	Top of Dam	53.0
9.	Test Flood	49.98

d. Reservoir (Length in Feet)

1.	Maximum Pool	7,000
2.	Recreation Pool	N/A
3.	Flood Control Pool	N/A

grades of 0.008 to 0.012 feet/foot, respectively. The several swampy areas in the watershed offer very little attenuation of large storm events. The average time of concentration for the overall drainage basin is estimated to be 60 minutes. This relatively short concentration period increases the probability that all surface runoff will peak simultaneously at the dam site during a high intensity rainfall event. The normal reservoir stage is elevation 45.0 and at that level will impound a supply of 1.6 billion gallons (4910 Ac/Ft) and have a water surface area equal to 375 acres. The available storage from this reservoir is 1.3 billion gallons (3990 Ac/Ft) and the dependable yield is estimated to be 3.0 MGD.

b. Discharge at Dam Site. There are no discharge records available for this dam. Listed below are calculated discharge values for the spillway and outlet works:

1. Outlet Works:

To Pachet Brook-42-inch diameter, Reinforced Concrete Pipe; downstream invert elevation 15.0. This pipe is also the outlet to the drop inlet spillway.

To Nonquid Reservoir-
24-inch diameter, Reinforced Concrete Pipe; invert elevation 16.0. for water supply only.

2. Maximum Known Flood at Dam Site - 119 cfs on May 20, 1978 (Estimated).

3. Drop inlet spillway capacity @ top of Dam - 390 cfs at Elevation 53.0
Emergency spillway capacity @ top of Dam - 1,038 cfs at Elevation 53.0
The maximum discharge capacity of the outlet works is equal to the maximum

h. Design and Construction History. This facility was constructed in 1960 for the City of Newport. Malcolm Pernie, Inc., Consulting Environmental Engineers, Two Corporate Drive, White Plains, New York designed the dam and its appurtenances and supervised construction. The General Contractor for the construction was Charter Oak Construction Company of Hartford, Connecticut. The work was completed in December, 1960, at which time the gates were closed and water collected. No subsequent construction work or major repair has occurred.

i. Normal Operating Procedures. Harold E. Watson Reservoir is operated as a standby supply for the water distribution system of the City of Newport, Rhode Island. Water is withdrawn by gravity from the impoundment at the rate of approximately 5.0 million gallons per day when required, through a 24-inch diameter pipeline to Nonquid Reservoir and pumping station, where it is pumped under the Sakonnet River to a surface storage reservoir in Portsmouth. As a rule, this supplemental supply is used in late summer. However, lack of precipitation to fill other reservoirs or an unusually high demand on the system has required its use earlier in the year on occasion.

1.3 Pertinent Data

a. Drainage Area. The Harold E. Watson Reservoir is located in Newport County in southeastern Rhode Island. The drainage basin lies in the coastal plain about 2.5 miles north of the village of Little Compton. The basin is generally rectangular in shape with a length of approximately 1.9 miles, a width of 1.9 miles, resulting in a total drainage area of 3.71 square miles (See Drainage Basin Map in Appendix D). The topography is generally flat with the elevations ranging from a high of 130.0 feet to a low of 45.0 feet at the spillway crest. Stream slopes and basin slopes are flat having

Brook through the 42-inch diameter conduit for water impounded in the reservoir above elevation 45.0. An emergency spillway is located on the right abutment of the embankment and is an open trapezoidal grassed channel with a base width of 20.0 feet, side slopes of 2.5H to 1.0V and an invert elevation of 48.5 feet.

c. Size Classification. The dam is classified as INTERMEDIATE in size because the impoundment storage at the top of the dam is 7857 Ac-Ft.

d. Hazard Classification. The dam is classified as a SIGNIFICANT hazard potential structure because it is located in a predominantly rural or agricultural area where failure may damage a few isolated homes (approximately ten), a secondary highway (West Main Road), and cause interruption of public utility service (Power and communications systems adjacent to the highway). See Appendix D for failure analysis. Loss of this surface water supply could cause severe economic hardships and potential health problems to the City of Newport.

e. Ownership. The Harold E. Watson Reservoir was constructed in 1960 by its present owner, the City of Newport, Rhode Island. The Reservoir is maintained and operated by the Newport Water Department.

f. Operator. Operating personnel are under the direction of:

Mr. Frederick W. Kent, Jr., Director
Newport Water Department
Halsey Street
Newport, Rhode Island 02840
(401) 847-0154

g. Purpose of the Dam. Harold E. Watson Reservoir Dam impounds water from Pachet Brook that is used in the water supply system of the City of Newport, Rhode Island.

1.2 Description of the Project

a. Location. H. E. Watson Reservoir Dam is located in Newport County, Rhode Island, approximately 2.5 miles northwest of the village of Little Compton, Rhode Island. (See Plate No. 1). The dam impounds water from Pachet Brook which drains a 3.7 square mile watershed of flat coastal terrain. The reservoir is formed into two connecting bodies of water with a total surface area of 375 acres at the drop inlet spillway crest elevation of 45.0. The impoundment is aligned in a northwest-southeast axis, with the dam located at the northwest extremity.

b. Description of Dam and Appurtenances. The Harold E. Watson Reservoir Dam is a zoned earth embankment with a partial foundation cut-off of compacted earth. The dam is 760.0 feet long, 38.0 feet in height, a width of 20.0 feet and a crest elevation of 53.0 feet National Geodetic Vertical Datum (NGVD). The upstream face of the embankment is sloped at 2.75H to 1.0V from the crest down to elevation 26.0 feet where the slope becomes 4.0H to 1.0V. The upstream slope is protected by stone armor up to Elevation 48.0. The downstream slope is approximately 2.5H to 1.0V and is grassed. A grassed surface roadway extends across the entire length of the embankment. (See overview photo C-1, 2, and construction drawings in Appendix B). The outlet control structure constructed of reinforced concrete is located at the approximate center of the earth embankment on the upstream slope in the reservoir and is connected by a concrete service bridge. Water is withdrawn from the wet well chamber of this structure through a 24-inch diameter concrete pipe and flows by gravity to the Nonquid Pumping Station Reservoir to the north. Water may also be by-passed from the outlet structure to Pachet Brook directly through a 42-inch diameter concrete pipe. A drop inlet spillway is constructed integrally with the outlet works and permits discharges into Pachet

NATIONAL DAM INSPECTION PROGRAM

PHASE I - INSPECTION REPORT

NAME OF DAM: HAROLD E. WATSON RESERVOIR DAM

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army through the Corps of Engineers to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. C-E Maguire, Inc., has been retained by the New England Division to inspect and report on selected dams in the State of Rhode Island. Authorization and notice to proceed was issued to C-E Maguire, Inc., under a letter from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0015 has been assigned by the Corps of Engineers for this work.

b. Purpose.

1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

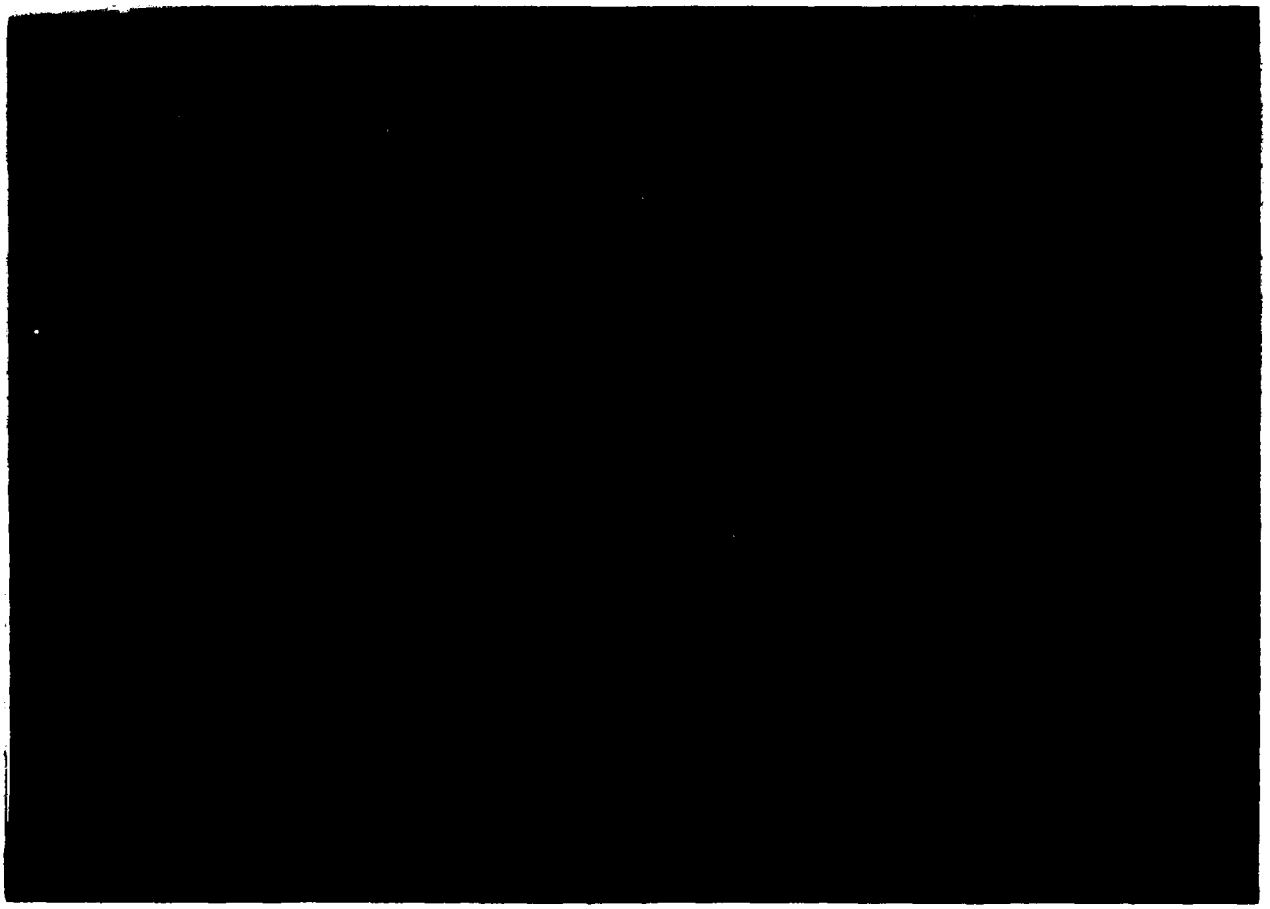
2. Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.

3. To update, verify and complete the National Inventory of Dams.

HAROLD E. WATSON RESERVOIR DAM

LOCATION PLAN

PLATE NO. 1



Overview Photo - Harold E. Watson Reservoir Dam

APPENDICES

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. Based on visual inspection and general appearance, the Harold E. Watson Reservoir Dam and appurtenances are in good condition. Unusual wear from trespass and damage from vandalism has been minimized by fencing. The main embankment supports a well-developed growth of grass and appeared to be well-maintained and trimmed at the time of the visual inspection. The outlet works is also fenced and secure. Control gates were in operation at the time of the inspection and were well lubricated and had exposed surfaces painted. The overall appearance of this facility is good.

b. Dam. The dam is an earthen embankment. The engineering drawings indicate the structure is comprised of zoned embankment materials, however, this was not confirmed during the site visit. See Photos C-1 through C-4.

1. Crest
The crest of the dam is covered with grass, and there is a vehicular path worn bare along the entire length of the crest. Photos C-1, 2.

2. Upstream Slope
The upstream slope is partially covered with riprap to within 16 feet of the crest measured along the slope. The riprap appeared to be in good condition. The remainder of the slope is covered with grass.

3. Downstream Slope
The downstream slope is covered with grass with a considerable amount of moisture-loving vegetation growing along the toe of the slope from the left edge of the outlet channel to approximately Station 6+0. See Photos C-3, 4.

Numerous small trees and brush exist downstream of the dam in this area. At approximately Station 5+10, there is an area of seepage approximately 20 feet beyond the toe of the downstream slope. A large clump of trees, 4 to 8 inches in diameter, have been uprooted in this area. The upper limit of this seepage area was about 18 feet below the level of water in the reservoir at the time of the inspection. The ground was noticeably wet and spongy at this location at the time of the inspection. Some water is flowing from this area, but it is clear with no evidence of turbidity. See Photo C-12.

To the west of the outlet channel the ground appeared slightly wet along the downstream slope to approximately Station 2+0. See Photo C-14.

Several animal burrows, up to 4 inches in diameter, were located on the downstream slope near Station 5+10. See Photo C-11.

There is a slight undulation of the downstream slope in the vicinity of Station 3+0 and 4+0. These undulations are distinguishable only when viewing the downstream slopes from a considerable distance. See overview photo.

The emergency spillway which exists along the eastern edge of the dam is well-grassed and maintained. A combination foot and motorbike path has been worn bare between the toe and crest of the spillway channel near Station 0+0. See Photo C-4.

c. Appurtenant Structures. No deleterious features were observed at the contact between the embankment and the outlet structure. There was evidence that water was being discharged into the stone riprap from the toe drains which surround the outlet structure.

The discharge on the right edge of the outlet structure appeared orange in color while the discharge along the left edge appeared clear. See Photo C-13.

Structurally, the appearance of the outlet works was good. There was no evidence of cracking or spalling of concrete. All joints were tight and in good alignment. Surfaces of the structure were level with no apparent settlement or movement. Some minor patching on the deck surface of the service bridge deck surface was noted. See Photos C-5, 7.

d. Reservoir Area. No specific detrimental features in the reservoir area were observed during the visual inspection. The slopes of the watershed are fairly gentle and well-covered with growth to preclude sloughing of shoreline material. Wave action resulting from the exposed location of this reservoir on the coastal plain is somewhat modified by the configuration (two connecting bodies of water) of the water surface.

e. Downstream Channel. The downstream channel for this dam is the natural bed for Pachet Brook. Immediately below the dam the channel is straight and generally perpendicular to the embankment. At a point approximately 1500 feet downstream the channel begins to meander and shortly thereafter passes beneath West Main Road through a rectangular bridge opening (11.5 ft. H x 7.0 ft. W) at about 3000 feet downstream and eventually flows to Almy Brook and the Sakonnet River. There are trees and vegetal growth overhanging the channel and to a lesser degree growing in the channel. No significant obstructions to flow were observed in the channel in the vicinity of the dam. See Photos C-8, 10.

3.2 Evaluation. Based on the visual inspection, the dam appears to be in good condition.

Minor trespassing has led to the development

of a bare path along the crest of the dam and another bare path from the crest across the base of the emergency spillway channel and up the adjoining slope near Station 0+0. Animal holes were located at several locations in the embankment. There is an extensive growth of brush, grass and small trees at the toe of the downstream slope and evidence (in the form of moisture-loving vegetation) that seepage may be emerging along many locations at or near the toe of the downstream slope. Visible seepage was located near the toe in the vicinity of Station 5+0. Other locations of visible seepage were not discernible due to the heavy vegetal growth along the toe as well as the low water surface level in the reservoir at the time of the inspection. The seepage at this time does not appear to be abnormal but needs to be monitored.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures. The Harold E. Watson Reservoir is the largest and most distant surface water supply reservoir in the Newport Water Supply system. Because of its remote location and the necessity to pump its water under the Sakonnet River by pipeline, the reservoir level is regulated as a reserve supply by the Newport Water Works to provide a safe and adequate yield for its users throughout the year. Generally, the water at Watson Reservoir is stored and held in reserve to replenish the losses from other impoundments in the system. Actual withdrawal of water occurs usually in late summer at a rate of 5.0 million gallons per day until November; however, weather conditions or unusual demands on the system can alter that schedule.

4.2 Maintenance of the Dam. Maintenance of the dam is the responsibility of the Director of Water Supply for the Newport Water Works. A part-time caretaker lives adjacent to the impoundment and he performs inspections of the facility on a weekly basis or as the situation demands. All maintenance problems are reported, assessed and programmed for corrective action as required. This facility appears to be well-maintained.

4.3 Maintenance of the Operating Facilities. All gates are operated annually usually at the time the reservoir is put into service. The caretaker, as a rule, inspects the gravity feed pipeline, which leads from the H. E. Watson impoundment to the Nonquid Reservoir Pumping Station, on a weekly basis. The mechanical equipment for the outlet control works, although in an exposed location appeared to be well-lubricated and in sound working condition at the time of the inspection. No record of inspection of the trash racks at the inlets for accumulation of sediment and debris was noted, although no difficulties have ever been reported.

4.4 Description of Any Warning System in Effect. Impending storms or intense rainfalls are monitored, as a rule, by Water Works operations and maintenance personnel from weather forecasts and the U.S. Weather Service (NOAA). During critical periods of high reservoir levels and approaching intense storm activity, both operating and engineering staff are on call and at the site, as needed.

There is no pre-planned warning system for the failure of the H. E. Watson Reservoir Dam. An emergency action plan must be developed so that operating personnel can notify authorities for mobilization of State or local emergency forces, organize remedial measures to minimize or prevent complete failure when possible, and have an awareness of the locations of supplies, standby equipment, and materials.

4.5 Evaluation. Operations and maintenance procedures for this dam and its appurtenances appear to be well-programmed and conducted. Maintenance of the facility is evident. An emergency action plan needs to be formulated and posted to insure proper and expedient action during critical periods.

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General. Harold E. Watson Reservoir, constructed by the City of Newport in 1960, is located on Pachet Brook about one mile southeast of Nonquid Reservoir and one mile east of West Main Road in Little Compton, Rhode Island. The dam has a drop inlet spillway and an emergency spillway at elevation 45.0 and 48.5 respectively. At the drop inlet spillway crest level, the impoundment has a total storage capacity of 4910 Ac-Ft that is equivalent to 24.8 inches of runoff from a watershed area of 3.71 square miles. Each foot of depth in the reservoir above spillway crest can accommodate a minimum of 375 Acre-Feet which represents 1.86 inches of runoff. This facility therefore is considered a storage dam with substantial capacity to modify and reduce peak inflows.

There is 8.0 feet of reservoir depth available between the top of the dam and the drop inlet spillway crest which can accommodate a large surcharge storage without overtopping. The spillway capacity for overflows is small, and therefore, this facility is considered a low spillage and large storage structure. Overtopping, although not likely, can be potentially hazardous for this grass-covered earth embankment.

b. Design Data.

The following hydraulic/hydrologic criteria were used in this Phase-I study.

i. The "Test Flood" and floods of lesser magnitude were developed for comparison purposes only based on approved and standard procedures including Corps of Engineers' guidelines for Phase-I studies and other accepted methodologies of computing the runoff. The hydrologic

characteristics such as upstream storage, basin slopes, watershed, shape, etc., were qualitatively assumed in adopting various inflow discharge values.

ii. For outflow values, (routing procedures) and dam failure profiles, a great emphasis was placed on the use of C.O.E. guidelines and Research Notes published by the Hydrological Engineering Center at Davis, California. Professional judgment was used in calculating final values outlined in this report, which are quite approximate and should not be considered a substitute for actual detail analysis.

No specific design data is available for this watershed or for the structures of the Harold E. Watson Dam. In lieu of existing design information, U.S.G.S Topographic Maps (Scale 1" = 2000') were utilized to develop hydrologic parameters such as drainage area, reservoir surface area, basin slopes, time of concentration and other runoff characteristics. Elevation - storage relationships for the reservoir were approximated. See Appendix D. Surcharge storage was computed assuming that the surface area remained constant above the spillway crest. Some of the pertinent hydraulic design data was obtained and/or confirmed by actual field measurements at the time of the visual field inspection.

Harold E. Watson Dam was classified as intermediate in size, having a storage of 7860 Acre-Feet at the top of the dam. The height of the dam is 36 feet. To determine the hazard classification for this dam, the impact of its failure at maximum pool (top of dam) was assessed. As a result of the analysis, this dam was classified as a significant hazard structure as detailed in Appendix D.

c. Experience Data. Records of operation are maintained by the Newport Water Department

for water surface levels and withdrawal to the system. These records indicate that the highest water surface level experienced by this storage was Elevation 45.67 on May 20, 1978, which produced a discharge through the drop inlet structure of 119 cfs (calculated). Discharges have never occured through the emergency spillway.

d. Visual Observations. No evidence of damage to any portion of the facility from high reservoir stage or wave action was visible at the time of the inspection.

e. Test Flood Analysis. Recommended guidelines for the Inspection of Dams by the Corps of Engineers were used for the selection of the "Test Flood". This dam is classified as a significant hazard and an intermediate size structure. Guidelines indicate that in this case, the magnitude of the "Test Flood" range from a full Probable Maximum Flood (PMF) as a maximum to one-half PMF as a minimum. One-half the PMF was adopted as the test flood for this dam. The total watershed drainage area is equal to 3.71 sq. miles of which 0.50 sq. miles is swampy and considered additional storage. Basin slopes average 0.012 feet/foot and are classified as flat.

The "Test Flood" equal to one-half the PMF for a relatively flat basin was calculated to be 700 csm, equivalent to 2600 cfs. Outflow discharges were routed through the reservoir in accordance with the guidelines and estimated to be 620 cfs.

f. Overtopping Potential. Based on the "Test Flood" Analysis, the spillway capacity is considered to be adequate to pass this storm event and overtopping of the dam would not occur.

The inflow and outflow discharge values for the test flood are 2600 cfs and 620 cfs, respectively. The maximum outflow capacity of the spillways (including the emergency spillway) under a stillwater condition,

without overtopping of the dam, is 1428 cfs, which is more than 100 percent of the test flood outflow.

At the spillway crest elevation of 45.0, the capacity of the outlet structure is 200 cfs. Using the outlet structure to regulate the water surface requires a period of 22.5 hours to lower the impoundment level one foot assuming a surface area equal to 375 acres. A spillway rating curve is included in Appendix D.

g. Dam Failure Analysis. With the impounded water surface level at the top of the dam, the calculated dam failure discharge will equal 49,715 cfs and that discharge will produce an approximate water surface level upon failure immediately downstream from the dam of Elevation 39.0. This failure discharge will raise the downstream water surface approximately 18.0 feet above the depth just prior to failure when the discharge is equal to 1428 cfs. The failure discharge will reduce from a depth of flow of 24.0 feet at the dam to normal uniform flow approximately 3000 feet downstream from the dam where the depth of flow will equal approximately 8.0 feet. This failure discharge will damage approximately ten homes, West Main Road and its adjacent power and communication systems. Loss of this surface water supply could cause severe economic hardships and potential health problems to the City of Newport. Approximate water surface elevations due to failure are listed in Appendix D.

HAROLD E. WATSON RESERVOIR DAM
INFLOW, OUTFLOW AND SURCHARGE DATA

FREQUENCY IN YEARS	24-HOUR TOTAL RAINFALL IN INCHES	24-HOUR* EFFECTIVE RAINFALL IN INCHES	MAXIMUM INFLOW IN C.F.S.	MAXIMUM** OUTFLOW IN C.F.S.	SURCHARGE STORAGE IN FEET	SURCHARGE STORAGE ELEVATION
10	5.0	2.6	655	88	1.36	46.36
50	6.5	4.1	1081	160	2.15	47.15
100	7.0	4.6	1265	208	2.41	47.41
1/2 PMF = TEST FLOOD	11.9	9.5	2600	620	4.98	49.98
= PMF =	21.4	19.0	5194	3412	8.91	53.91

*Infiltration assumed as 0.1"/hour

**Lake assumed initially full at spillway crest elevation 45.0 .
(Top of dam = 53.0 .)

NOTES:

1. Q_{10};Q_{50};Q_{100}; inflow discharges computed by approximate methodology of Soil Conservation Service.
2. 1/2 PMF equal to the "test flood" computation is based on COE instructions and guidelines.
3. Maximum capacity of drop inlet spillway without overtopping the top of the dam elevation 53.0 is equal to 390 C.F.S. An additional capacity of 1038 C.F.S. is available at emergency spillway crest elevation of 48.5±.
4. Surcharge storage is allowed to overtop the dam when exceeding the spillway capacity.
5. Test flood = one half the PMF = 700 CSM = 2600 CFS (D.A. = 3.71 Sq. miles).

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation: The dam is an earthen embankment. The crest of the dam is covered with grass and there is a path worn bare along the entire length of the crest. The upstream slope is covered with grass and riprap up to Elevation 48.

The downstream slope is grass covered and has slight undulations at several locations. Along a considerable length of the toe of the west side of the dam, there is extensive moisture-loving vegetation, the upper limit of this vegetation was approximately 18 feet below the level of the water in the reservoir At the time of inspection there was some evidence that seepage was discharging at the time of the inspection.

Along the toe of the east side of the dam, the ground was damp, but had no visible signs of seepage.

Numerous small 4-inch diameter animal holes were seen on the downstream face.

b. Design and Construction Data: The design drawings presented in the previously noted sources (see Section 2 and Appendix B) do not point to any sources or areas of structural instability. It was not possible to observe the outlets of the filter drains which discharge into the stone riprap surrounding the outlet structure.

c. Operating Records: No information is available about the operation insofar as they are pertinent to the embankment or foundations.

d. Post-Construction Changes: No post-construction changes pertinent to the embankment or foundations have occured.

e. Seismic Stability; This dam is in Seismic Zone 2 and hence does not require evaluation for seismic stability according to the USCE Recommended Guidelines.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition: The visual inspection indicates that the Harold E. Watson Reservoir Dam is in good condition. The concerns regarding the long-term performance of this dam are:

1. The apparent seepage areas along the downstream toe of the dam on the left side of the outlet channel, the area of seepage near the outlet channel on the right side of the dam, and seepage in the vicinity of Station 5+0 needs to be monitored.

b. Adequacy of information: The lack of in depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data; but it is based primarily on visual inspection, past performance history and sound engineering judgment.

c. Urgency: The recommendations and remedial measures described below should be implemented by the Owner within two years after receipt of this Phase I Inspection Report.

d. Need For Additional Investigation: No information or observations indicate that the Harold E. Watson Reservoir Dam requires a comprehensive investigation at this time. However, the recommendations and remedial measures outlined in 7.2 and 7.3 will require some additional engineering inputs, analysis, and designs.

7.2 Recommendations: It is recommended that the Owner engage the services of an engineer

APPENDIX B

ENGINEERING DATA

B-1 Listing of Locations for Available Correspondence
B-2 Copies of Past Inspection Reports
B-3 Plans, Sections, Details

PERIODIC INSPECTION CHECK LIST

PROJECT Harold E. Watson Reservoir Dam DATE November 16, 1978

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	
a. Super Structure	
Bearings	Rubberized Fabric Pads
Anchor Bolts	None Observed
Bridge Seat	Good condition
Longitudinal Members	R/C Slab - Good Condition
Under Side of Deck	Slight efflorescence
Secondary Bracing	None
Deck	Good Condition/Slight Cracking Patched
Drainage System	Patched to Drain
Railings	Galvanized steel
Expansion Joints	None
Paint	Railings well maintained
b. Abutment & Piers	
General Condition of Concrete	Good
Alignment of Abutment	Good
Approach to Bridge	Level perpendicular to crest of dam
Condition of Seat & Backwall	Good

PERIODIC INSPECTION CHECK LIST

PROJECT Harold E. Watson Reservoir Dam DATE November 16, 1978

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	Drop Inlet Structure No approach channel
b. Weir and Training Walls	
General Condition of Concrete	Good
Rust or Staining	None Observed
Spalling	None Observed
Any Visible Reinforcing	None Observed
Any Seepage or Efflorescence	None Observed
Drain Holes	None Observed
c. Discharge Channel	See Discharge Channel for Outlet Works

PERIODIC INSPECTION CHECK LIST

PROJECT Harold E. Watson Reservoir Dam DATE November 16, 1978

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Good
Rust or Staining	None
Spalling	None Observed
Erosion or Cavitation	None
Visible Reinforcing	None Observed
Any Seepage or Efflorescence	Seepage noted from toe drain around outlet headwall. Rust colored
Condition at Joints	Good
Drain Holes	None Observed
Channel	
Loose Rock or Trees Overhanging Channel	Yes. Small trees
Condition of Discharge Channel	Not cleared and maintained along banks. Fair condition.

PERIODIC INSPECTION CHECK LIST

PROJECT Harold E. Warson Reservoir Dam DATE November 16, 1978

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	Outlet conduit through embankment is a 42" R/C pipe to Pachet Brook
Erosion or Cavitation	A 24" R/C pipe is the supply to Nonquid pumping to the North Gate Valve on 24" pipeline, approx. 200' north of toe of dam
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST

PROJECT Harold E. Watson Reservoir Dam DATE November 16, 1978

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Good
Condition of Joints	Tight
Spalling	None observed
Visible Reinforcing	None observed
Rusting or Staining of Concrete	None observed
Any Seepage or Efflorescence	None observed
Joint Alignment	Good
Unusual Seepage or Leaks in Gate Chamber	None Observed
Cracks	None
Rusting or Corrosion of Steel	None
b. Mechanical and Electrical	Not Applicable

PERIODIC INSPECTION CHECK LIST

PROJECT Harold E. Watson Reservoir Dam DATE November 16, 1978

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INLET STRUCTURE	
a. Approach Channel	
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	None. Intake is a drop inlet
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	Reinforced Concrete Structure
Condition of Concrete	Good
Stop Logs and Slots	None

PERIODIC INSPECTION CHECK LIST

PROJECT Harold E. Watson Reservoir Dam DATE November 16, 1978

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
DIKE EMBANKMENT	None

PERIODIC INSPECTION CHECK LIST

PROJECT Harold E. Watson Reservoir Dam DATE November 16, 1978

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT (cont.)	
Foundation Drainage Features	Plans indicate filter drain not observed in field
Toe Drains	
Instrumentation	None
Vegetation	Grass cover well maintained, should be removed to 20' beyond toe

PERIODIC INSPECTION CHECK LIST

PROJECT Harold E. Watson Reservoir Dam DATE November 16, 1978

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	EL 53.0
Current Pool Elevation	EL 42.61
Maximum Impoundment to Date	Unknown
Surface Cracks	None observed
Pavement Condition	Gravel Road on Crest - good condition
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	No discernable settlement (Slight Downstream Slope)
Horizontal Alignment	No discernable settlement (Undulating)
Condition at Abutment and at Concrete Structures	
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	Motorcycle tracks on crest and on Emergency spillway "Woodchuck Holes"
Sloughing or Erosion of Slopes or Abutments	
Rock Slope Protection - Riprap Failures	None. Stonework - good condition
Unusual Movement or Cracking at or near Toes	None observed
Unusual Embankment or Downstream Seepage	Seepage observed all along downstream toe
Piping or Boils	None observed

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Harold E. Watson Reservoir Dam DATE November 16, 1978

TIME 8:30 AM

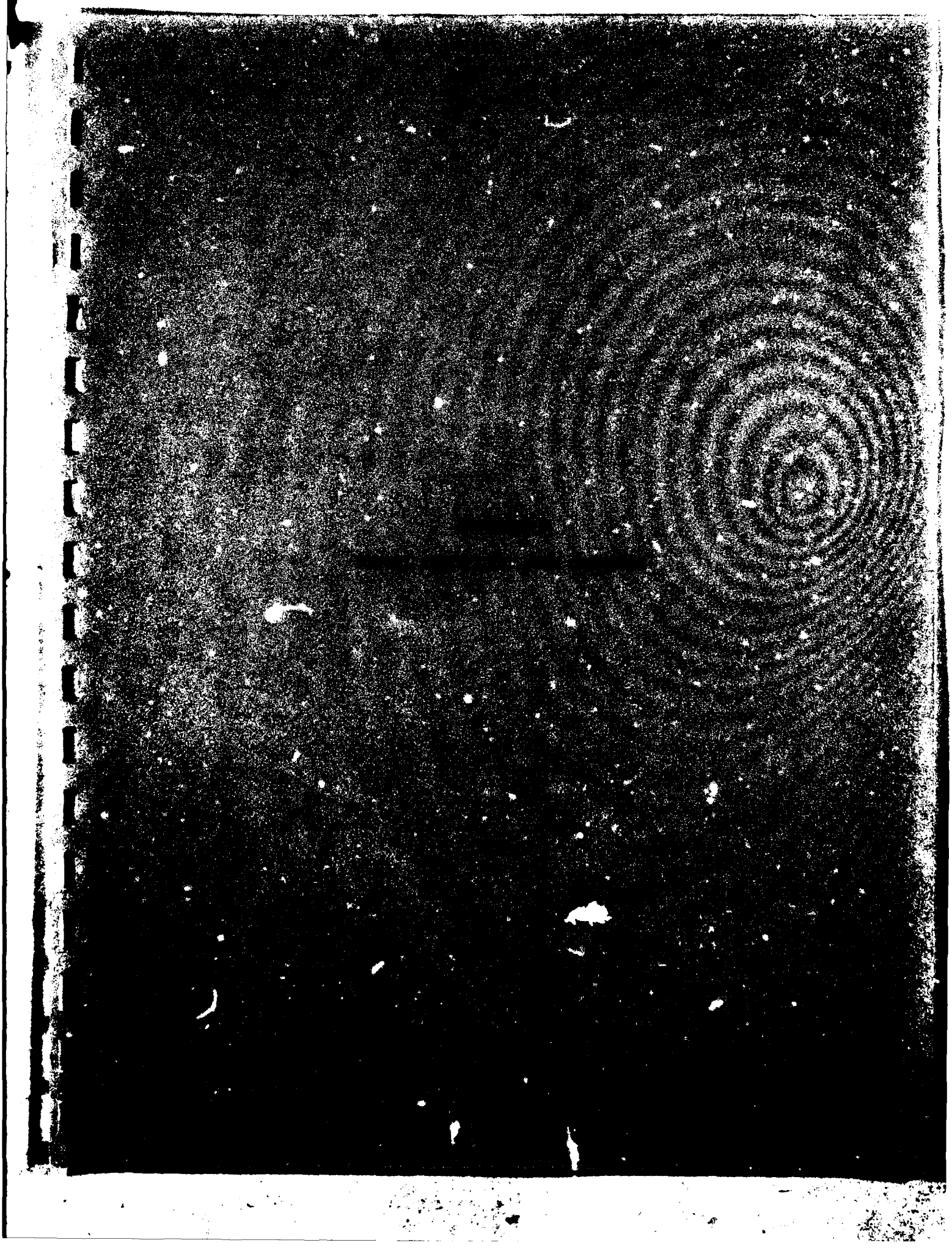
WEATHER Overcast 40 F

W.S.ELEV. 42.6 U.S. 16.5 D.S.

PARTY:

1.	Mr. Leo Ayotte Collection System Supt.	6.	E. Prout DEM
2.	A. Reed	7.	
3.	R. Brown	8.	
4.	S. Khanna	9.	
5.	R. Murdock	10.	

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			



failure. It should include the expedient action to be taken, authorities to be contacted, and locations of emergency equipment and materials.

7. Continue the technical inspection of this facility every two years.

8. All animal burrows should be backfilled and those areas re-seeded on an annual basis.

7.4 Alternatives: (Not Applicable)

experienced in the design of earth dams to conduct an investigation of the apparent seepage along the downstream toe on both the right and left sides of the embankment, and the filter drain exit point at the outlet structure. A collection system should be designed in order that the quantity and turbidity of the seepage can be monitored. Additionally, he should consider in this system, the installation of piezometers to determine the location of the free water surface near the toe of the dam.

7.3 Remedial Measures

a. Operating and Maintenance Procedures

1. The Owner should clear the trees and brush for a distance of 30 feet downstream from the embankment toe and maintain that area in an open and clear condition.

2. The Owner should take such action as is necessary to prevent trespass on the crest, slopes and abutments of the dam and its appurtenances, particularly on those grass areas subject to erosion.

3. Seepage at the downstream toe of the dam should be monitored on a weekly basis. Records of the quantity of seepage, its color and solids content, the location of the exit points, as well as photographs should be included in the monitoring program.

4. Brush, vegetation and small trees should be removed from the outlet channel on a regular basis.

5. A program should be implemented for the regular recording of data for such items as: water surface levels, discharges, and time of drawdown to assist those responsible for the monitoring and operation of the structure.

6. Develop and post an emergency action plan including a warning system in order to prevent or minimize the impact of dam

APPENDIX B-1

1. Design, Construction and Maintenance Records and Locations

a. Contract Documents, Correspondence operational records

Newport Water Department
Halsey Street
Newport, Rhode Island 02840

b. Inspection Reports

Department of Environmental Management
State of Rhode Island
83 Park Street
Providence, Rhode Island 02903

c. Designers

Malcolm Pirnie, Inc.
Consulting Engineers
Two Corporate Drive
White Plains, New York

APPENDIX B-2

Copies of Past Inspection Reports

13 September 1978

Mr. Frederick W. Kent, Jr.
Newport Water Department
Halsey Street
Newport, RI 02840

Re: H. E. Watson Reservoir Dam - R.I. Dam #485

Dear Mr. Kent:

The State of Rhode Island, through its Department of Environmental Management, is currently conducting safety inspections throughout the state in conformance with federal guidelines set forth in the National Program for the Safety Inspection of Dams, Public Law 92-367.

It is the responsibility of this Department to perform these inspections and evaluations as they pertain to the potential hazards to human life and property.

As owner and/or operator of the H. E. Watson Reservoir Dam (R.I. Dam #485), please be advised that a potentially serious condition was noted which we consider warrants your attention. Specifically, a wet, saturated soil condition of undetermined origin exists around the perimeter of the concrete outlet structure.

Therefore, we recommend an investigation of this condition by your engineering department to determine its source and whether, in your opinion, it warrants immediate corrective action.

Please inform this office at your earliest convenience of your intentions as they pertain to the disposition of this matter. Also, if this office can be of any assistance or you would like us to join your staff for an on-site inspection, please do not hesitate to contact us.

Very truly yours,

Peter M. Janaros, P.E., Chief
Division of Land Resources
Department of Environmental Management

PMJ/cc
cc: Dams Section

R. I. DEPARTMENT OF NATURAL RESOURCES
Division of Planning & Development

MEMO

9/15/78

TO: File
FROM: E. L. Leonard, Jr.
SUBJECT: H. E. Watson Res. Dam # 485

Received phone call from Mr. Fred Kent relative to our letter of 9/13/78. He requested we meet with him at dam site on 9/20/28 for further inspection and evaluation of deficiencies.

This was agreed to and will meet @ 9:30 AM.

PMJ

EFP

MEMORANDUM

RECEIVED

SEP 22 1978

NATURAL RESOURCES
WETLANDS SECTION

September 20, 1978
Date

#485 E.F.P.

TO: City Manager

FROM: DEPARTMENT OF WATER, Halsey Street, Newport, R. I. 02840

SUBJECT: H. E. Watson Reservoir Dam

On Wednesday, September 20, 1978, Mr. Peter M. Janaros, Chief, Division of Land Resources, Department of Environmental Management, Mr. Earl Prout of the Department of Environmental Management and myself inspected the H. E. Watson Reservoir Dam for possible leak.

It was determined that water samples be taken from the reservoir and at the over-flow structure to check the chemistry of the water. It is possible this may show it is ground water and not reservoir water. Also, the (as built) plans were reviewed and it appears that the filter drains and stone drains are working properly.

It was recommended that since Malcolm Pirnie Engineers designed and built this dam, that we have them make a thorough inspection of the dam at the earliest possible date. This dam was built in 1960.

I have contacted Mr. John Foster, president of Malcolm Pirnie, and we expect an engineer will be here shortly.

A copy of Mr. Janaros's letter is attached.

Frederick W. Kent, Jr.
Director of Water

FWK/jfw
Attachment
cc: Mr. Peter M. Janaros, Chief

PHOTOS TAKEN SEPT. 25, 1978

(callback of investigati

PHOTO #1. Base of downstream slope, looking westerly from outlet structure.

PHOTO #2. Looking down @ outlet structure & discharge channel.

PHOTO #3. Attempt to show discoloration of water on right side due to ironization.

PHOTO #4. Wet area on right (easterly) side of outlet structure.

DAM #465
H. E. WATSON RES.

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

DAM INSPECTION REPORT

DAM: 485 **RIVER:** Packet Brook **WATERSHED:** Coastal/Pokonnet **DATE:** 26 July 1978

NAME: T. E. Watson Res. Dam **TOWN:** Little Compton **INSPECTED BY:** Carle P. Trout, Jr.
Carmine P. Agnitio

OWNER: City of Newport
c/o Newport Water Dept.
Halsey Street
Newport, RI 02840

OTHER INTERESTED PARTY:
c/: Frederick W. Kent, Jr., Esq.

REASON FOR INSPECTION: N.P.S.I.D. - High/Intermediate Hazard - Annual Inspection

* * * * * * * * * *

REPORT:

General - Dam built in 1960
Current elevation of pool - full (@ elev. 45.9')

Embankment: The impoundment is contained on the northwesterly side by an earthen dam embankment with Class "A" rolled select material core and the balance contained by the natural slope of the terrain. Both sides of embankment are clear of trees and shrubs except at the base of embankment adjacent to the outlet for the control structure and along the banks of the outlet channel. This vegetation, however, does not currently impede the natural discharge of water. (photos 4 and 5)

There are occasional signs of trespass of burrowing animals. The pond side of embankment is lined the entire length with 18"-24" rip-rap which shows no current signs of displacement. There are no signs of erosion or wash out of top soil along the crest or adjacent to concrete abutments or other structures. There are signs of leakage or seepage around the outlet structure (photos 4 and 5) the source of which is unknown. It is currently causing a muddy condition around outlet structure and warrants future watching.

Gates: The channel approach to the control structure is clear of any obstructions. The concrete control structure is presently secured and in very good condition (photo #2

The gate operating stems appear to be in good condition and leave no reason to suspect the inoperability of the sluice gates below. The concrete outlet structure at the base of the embankment is in good condition with no signs of scouring or spalling. The trees currently small in size should be cut before they pose a threat to the natural flow of water in the discharge channel.

Spillway: The concrete "ogee inlet" type spillway, which is an integral part of the control structure, is in good condition with no signs of spalling or scouring of the concrete and is clear of any obstructions. The metal rips train rack shows no signs of rusting or spalling.

DAM INSPECTION REPORT (Continued) #[illegible] - Pachet Brook

Emergency Spillway: Approximately 150' east of control structure is about 3' (max.) above elevation of drop inlet spillway. It is clear of any vegetation of an obstructive nature (photo #6) and its grassed sluiceway returns back to the natural stream of Pachet Brook (approx. 450-500' downstream).

Comments/Recommendations: The dam is in very good condition. The confirming letter of inspection to the owner, however, should call attention to the muddy leaking condition around the outlet structure and request that it be repaired -- along with the cutting of trees and shrubs along the discharge channel.

PHOTO NO. #1. General view of earthen dam embankment showing existing condition of pond side of slope with placement of 18"-24" rip-rap. Looking eastward toward control structure.

PHOTO #2. General view of downstream slope of dam embankment (looking eastward)

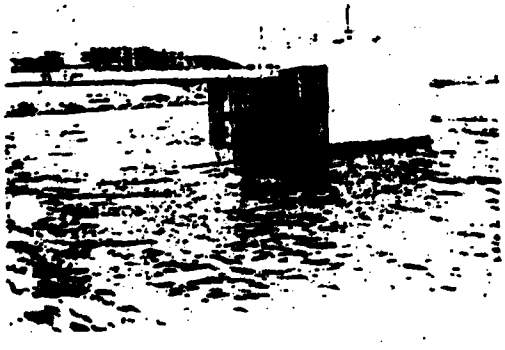


PHOTO #3. Concrete control structure with "drop-inlet" type spillway. Pond currently full at elev. 45:0'

DAM #485
H. E. Watson Reservoir Dam

../..

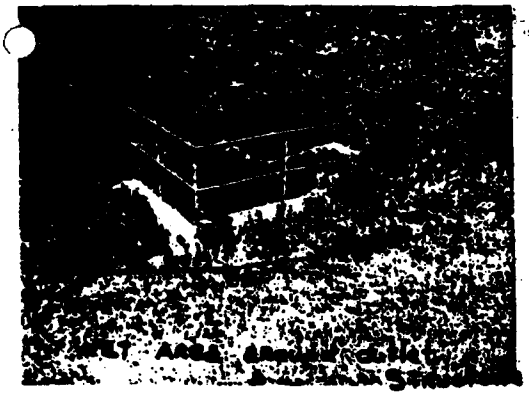


PHOTO # 4. Concrete outlet structure at base of slope on downstream side of dam embankment. Note wet area.

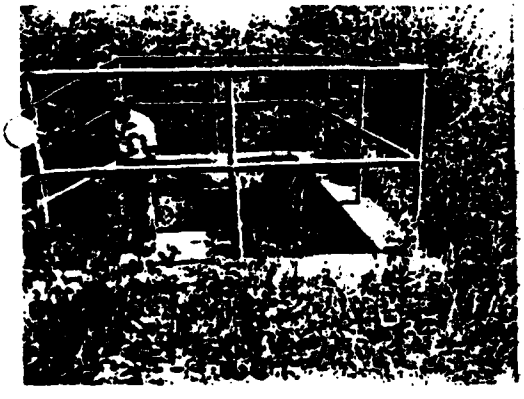


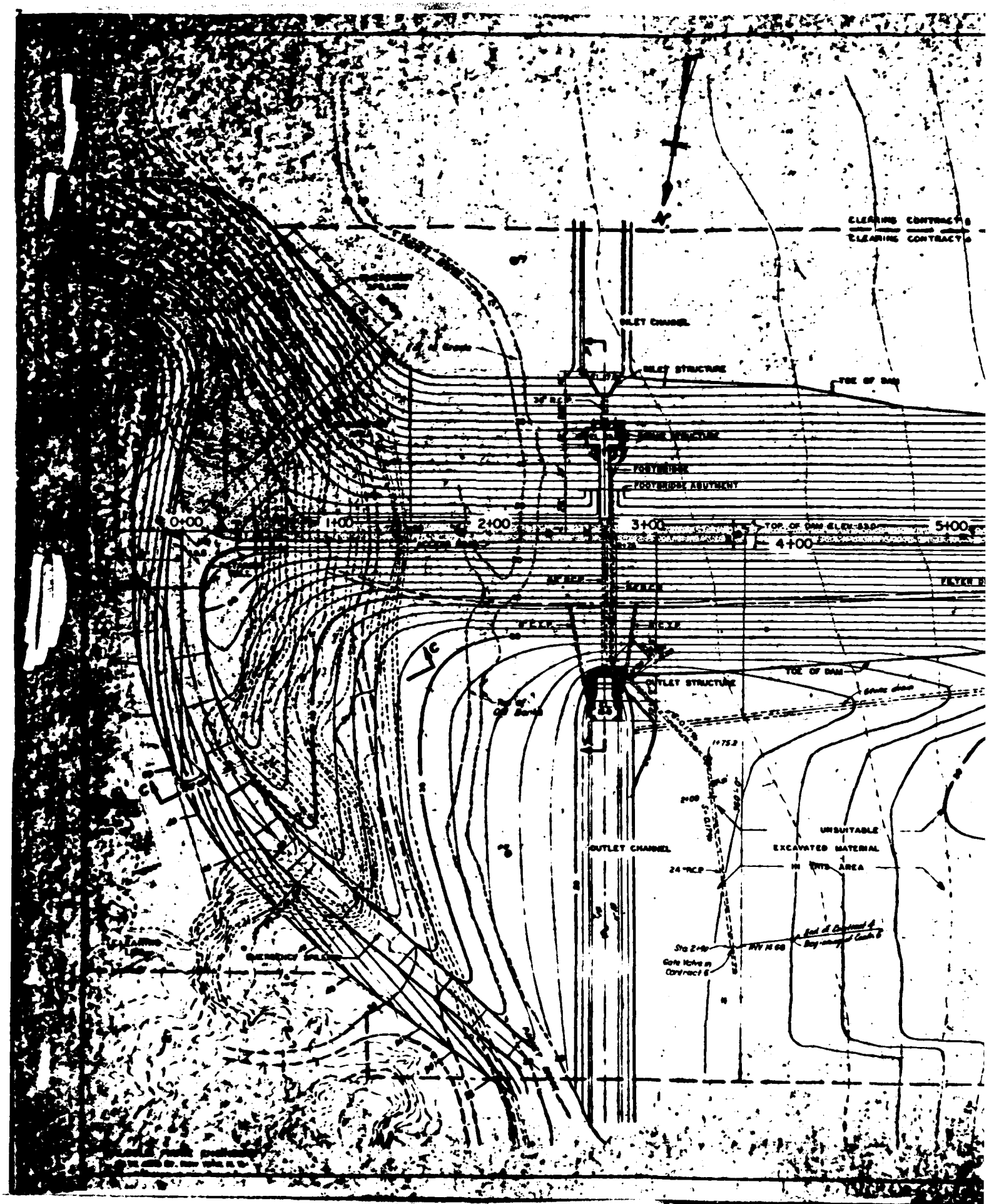
PHOTO #5. Concrete outlet structure.

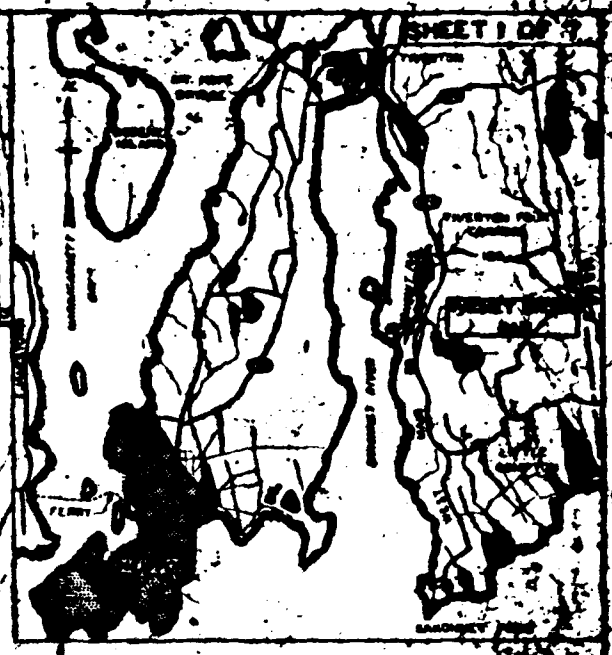
PHOTO #6. General view of emergency spillway looking northward (downstream) Concrete retaining wall acts as a training wall to this area.

DAM #485
H. E. Watson Res. I

APPENDIX B-3

Plans, Sections, Details


CLEARING CONTRACT B
CLEARING CONTRACT C
INLET CHANNEL
INLET STRUCTURE
TOE OF DAM
36" RCP
FOOTBRIDGE
FOOTBRIDGE ABUTMENT
0+00
1+00
2+00
3+00
4+00
5+00
TOP OF DAM ELEV. 830
OUTLET STRUCTURE
TOE OF DAM
OUTLET CHANNEL
UNSUITABLE
EXCAVATED MATERIAL
IN THIS AREA
24" RCP
Sta 2+40
Gate Valve in
Contract C



LOCATION PLAN

SCALE 1/2 0 1 MILE

CLEARING CONTRACT 6

CLEARING CONTRACT 5

TOE OF DAM

TOP OF DAM ELEV. 230

5+00

6+00

4+00

PECKET BROOK DAM

TOE OF DAM

CLEARING LINE

UNSUITABLE EXCAVATED MATERIAL IN THIS AREA

LEGEND

- Original contours
- Final contours
- Spot elevations
- Survey baseline
- Gravel Road
- Indicates thereafter line of clearing to be observed

GENERAL NOTES

1) Elevations are in U.S.C. & G.S. datum 35 feet higher than mean sea level.

2) Indicated contours are at two (2) foot intervals.

RESERVOIR CAPACITY

DEPTH BELOW SPILLWAY FEET	INCHES	CAPACITY MILLION GALLONS
0	0	1000
1	12	1400
2	24	1300
3	36	1250
4	48	1140
5	60	1060
6	72	990
7	84	900
8	96	770
9	108	690
10	120	600
11	132	525
12	144	455
13	156	390
14	168	325
15	180	270
16	192	225
17	204	180
18	216	150
19	228	120
20	240	90

"AS BUILT"

CITY OF NEWPORT, RHODE ISLAND

NEWPORT WATER WORKS

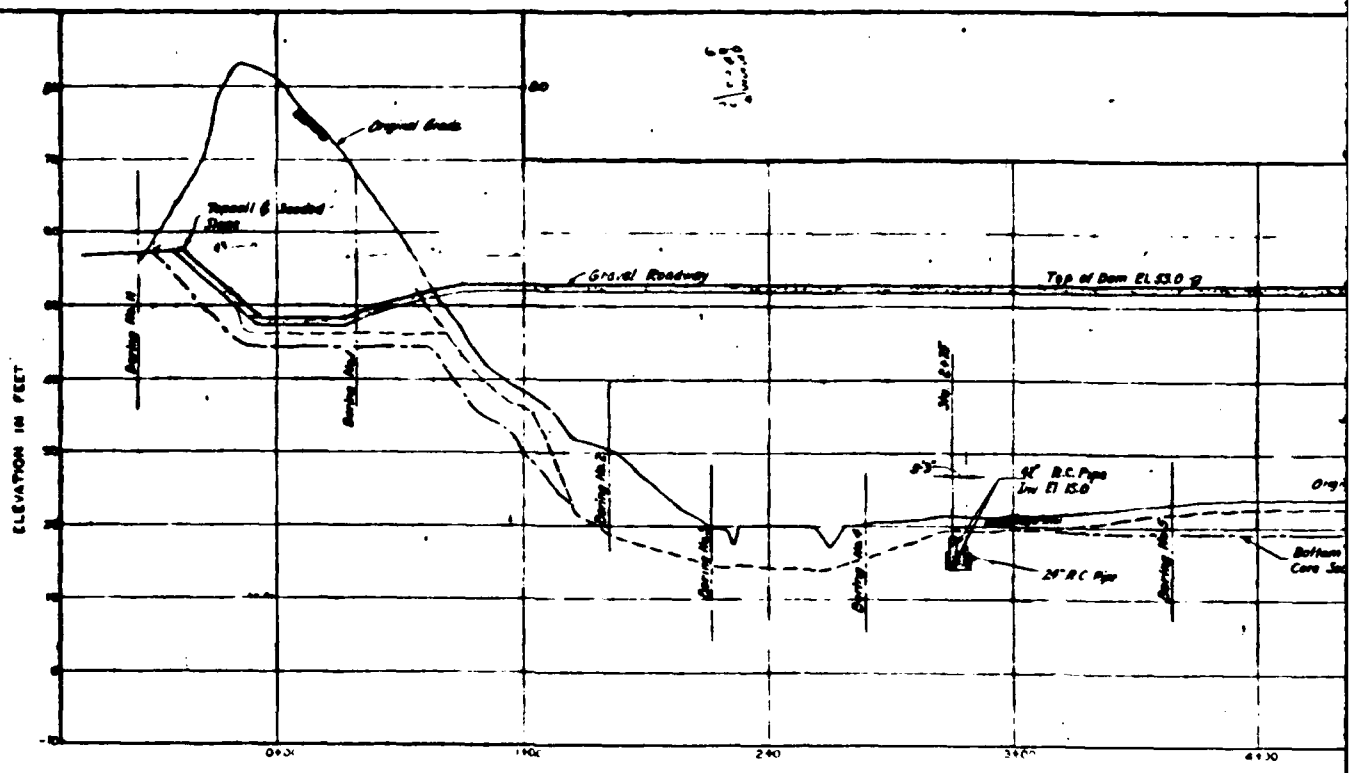
CONTRACT NO. 4

PACHET BROOK DAM

GENERAL PLAN

SCALE 1" = 50'

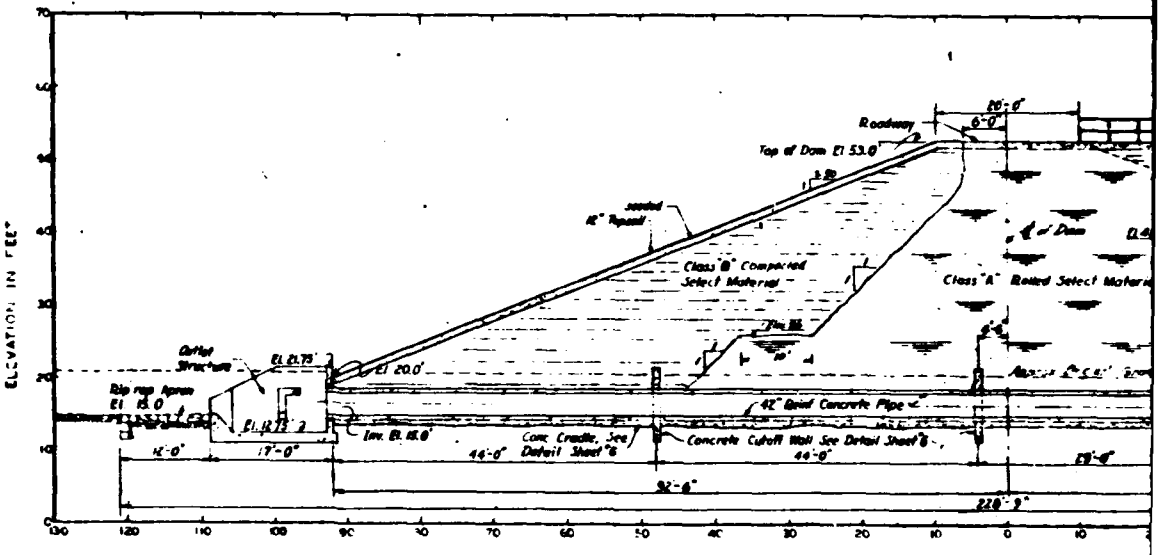
DWG. 178-50-001 - 6th JAN. 1959



DISTANCE IN 100 FOOT STATIONS

CENTER LINE PROFILE OF DAM

SCALES: HORIZ. 1" = 30'
VERT. 1"=10'



SECTION A-A

SCALE: 1"=10'

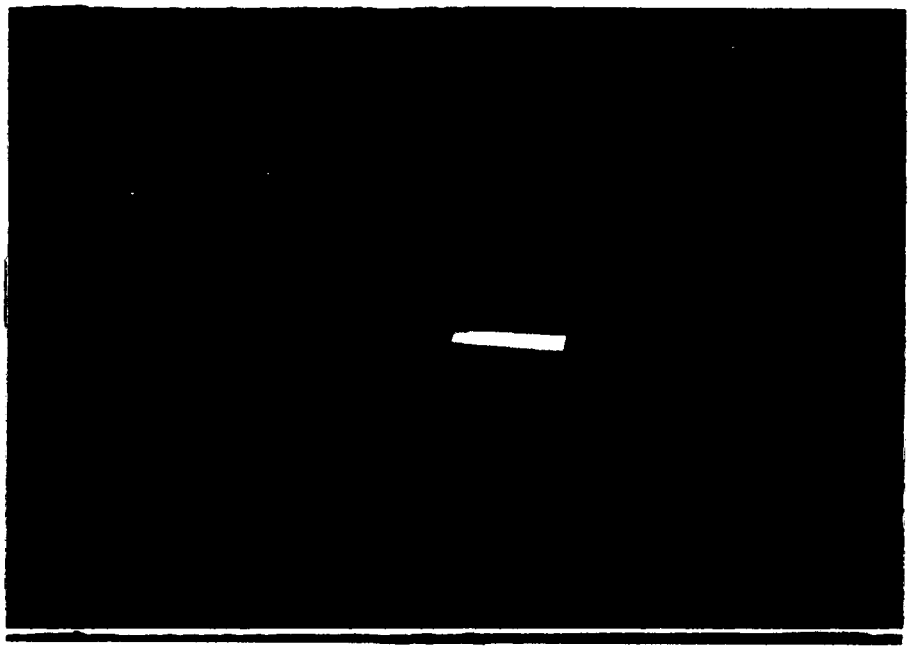
MALCOLM PIRNIE ENGINEERS

APPENDIX D

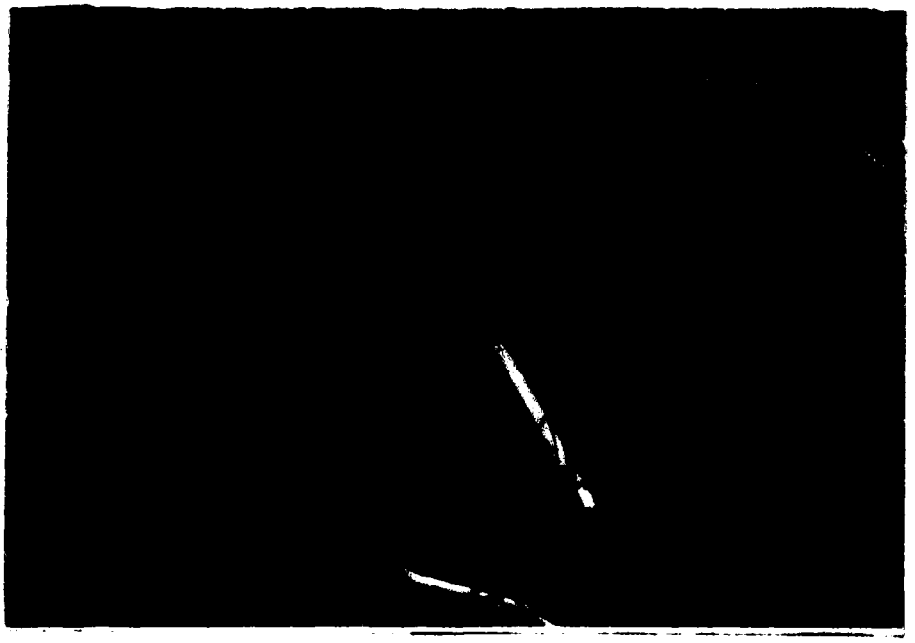
HYDROLOGIC AND HYDRAULIC COMPUTATIONS

C-13 SEEPAGE EMERGING FROM OUTLET STRUCTURE. POSSIBLY FROM TOE DRAINS

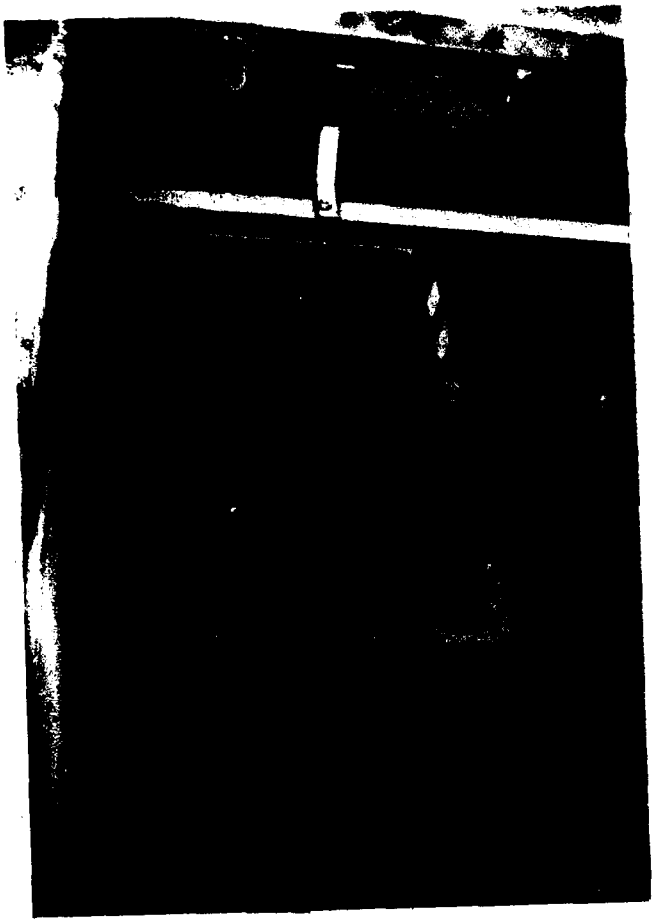
C-14 SEEPAGE EMERGING AT DOWNSTREAM TOE OF DAM



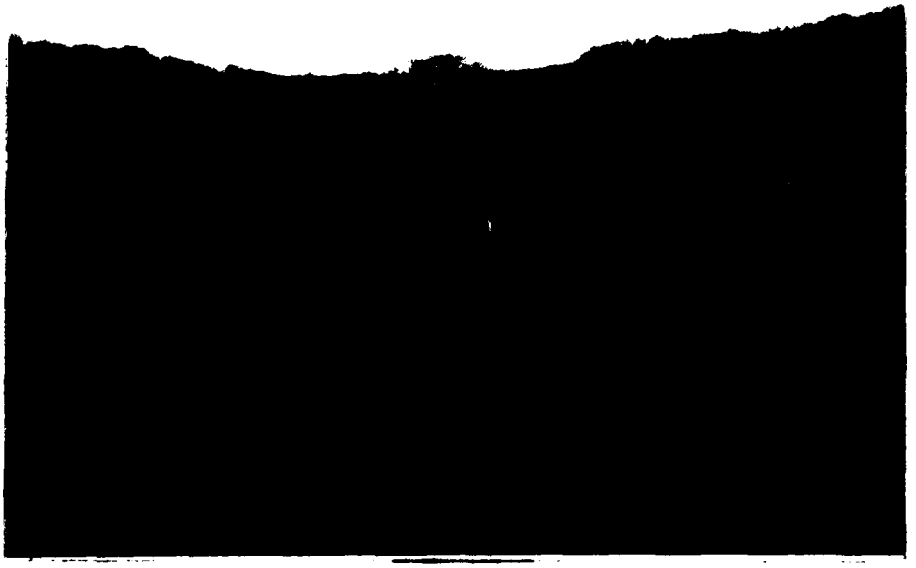
C-11 "WOODCHUCK HOLE" ON DOWNSTREAM EMBANKMENT SLOPE



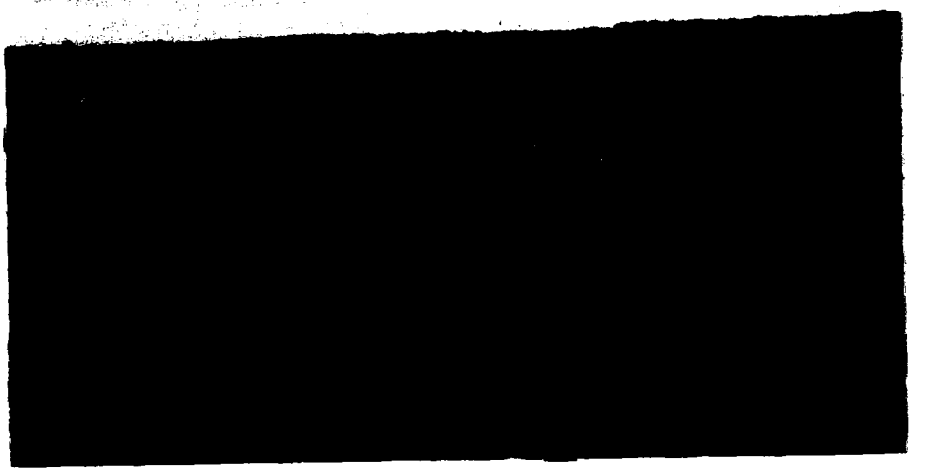
C-12 SEEPAGE ALONG DOWNSTREAM TOE OF DAM



C-9 RECTANGLUAR DROP INLET SPILLWAY WITH TRASH RACK PROTECTION

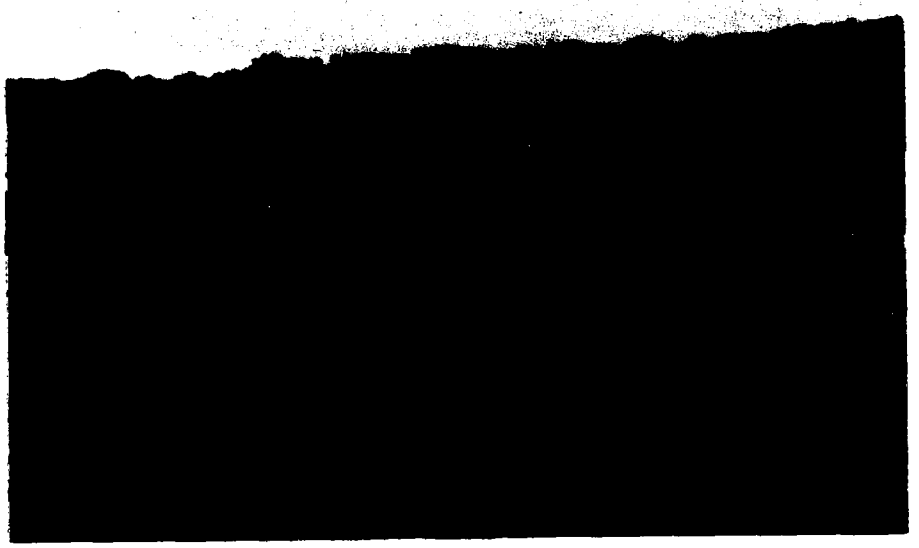


C-10 DOWNSTREAM CHANNEL



C-7 SLUICE GATE CONTROL STANDS

C-8 OUTLET STRUCTURE-LOOKING DOWNSTREAM

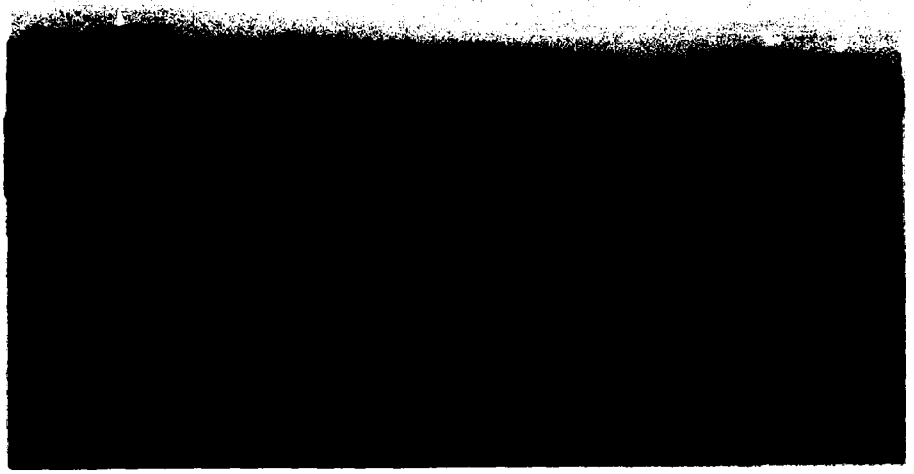


C-5 INTAKE STRUCTURE OF THE OUTLET WORKS WITH SERVICE BRIDGE FROM EMBANKMENT IN FOREGROUND.

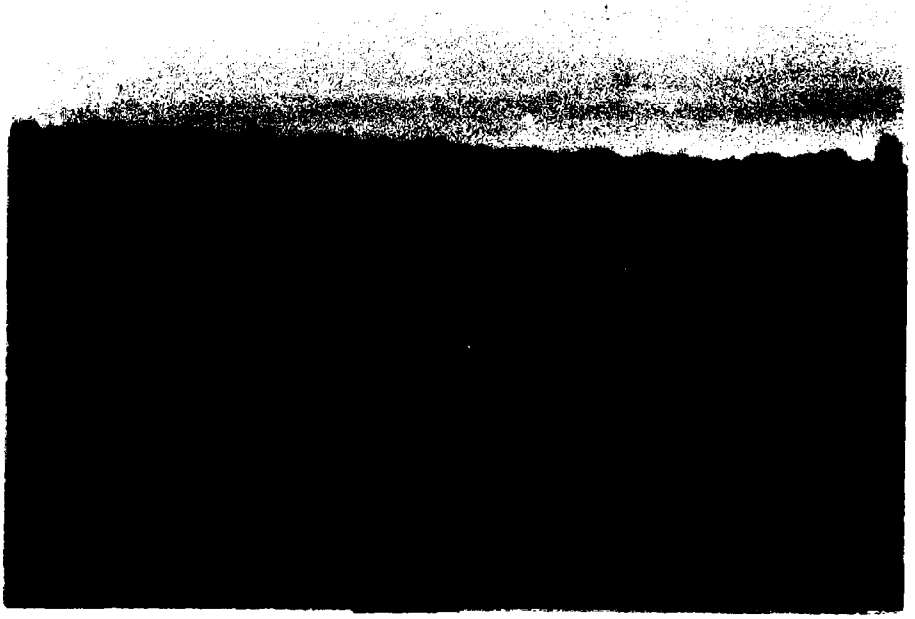
C-6 OUTLET STRUCTURE AND OUTLET PIPE

C-3 CREST AND DOWNSTREAM SLOPE OF EMBANKMENT-LOOKING FROM LEFT ABUTMENT AREA

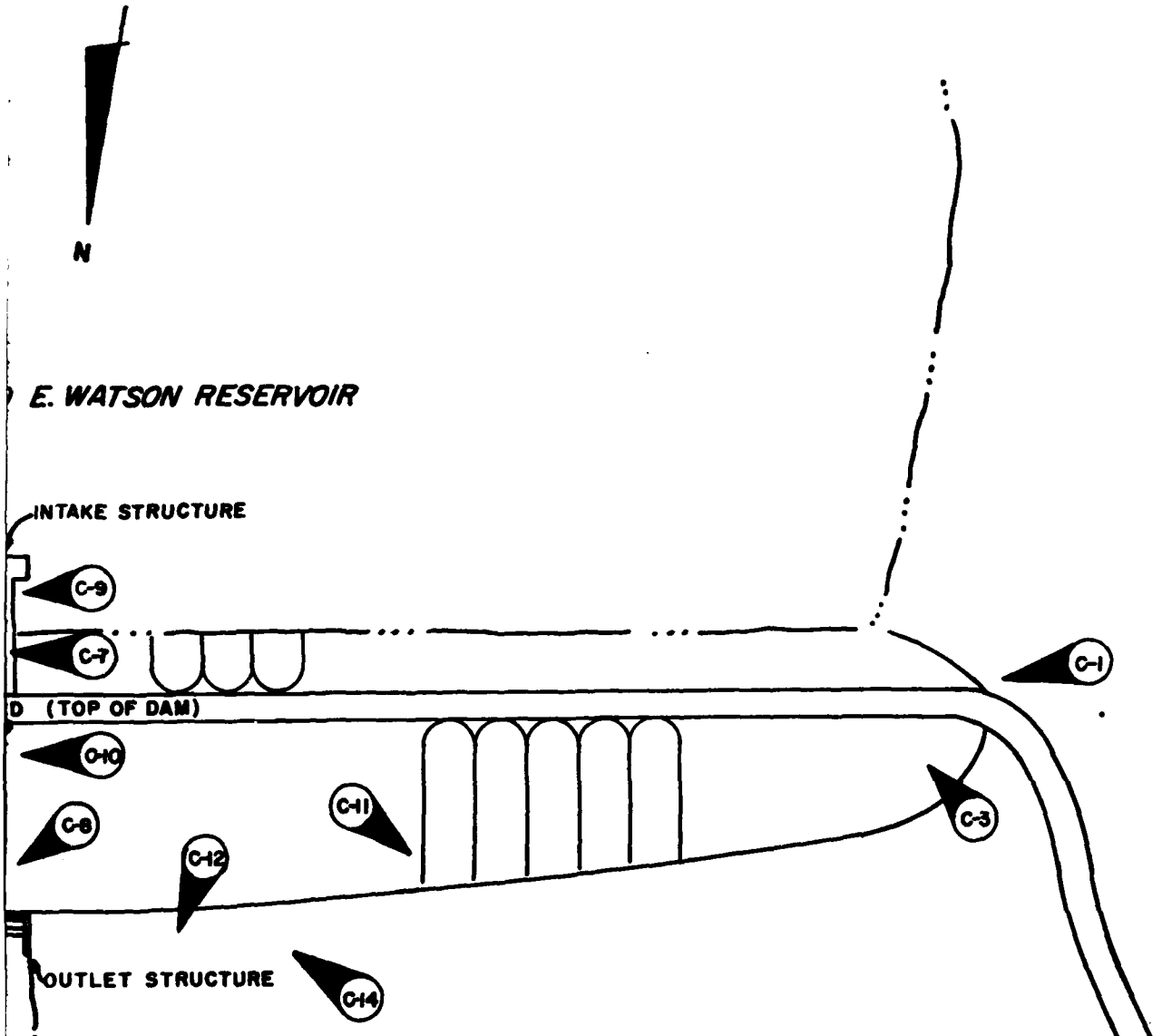
C-4 DOWNSTREAM SLOPE OF EMBANKMENT-LOOKING FROM HIGH GROUND BEHIND THE RIGHT ABUTMENT AREA. NOTE EMERGENCY SPILLWAY IN FOREGROUND.



C-1 CREST AND UPSTREAM SLOPE OF EMBANKMENT-LOOKING FROM LEFT ABUTMENT AREA



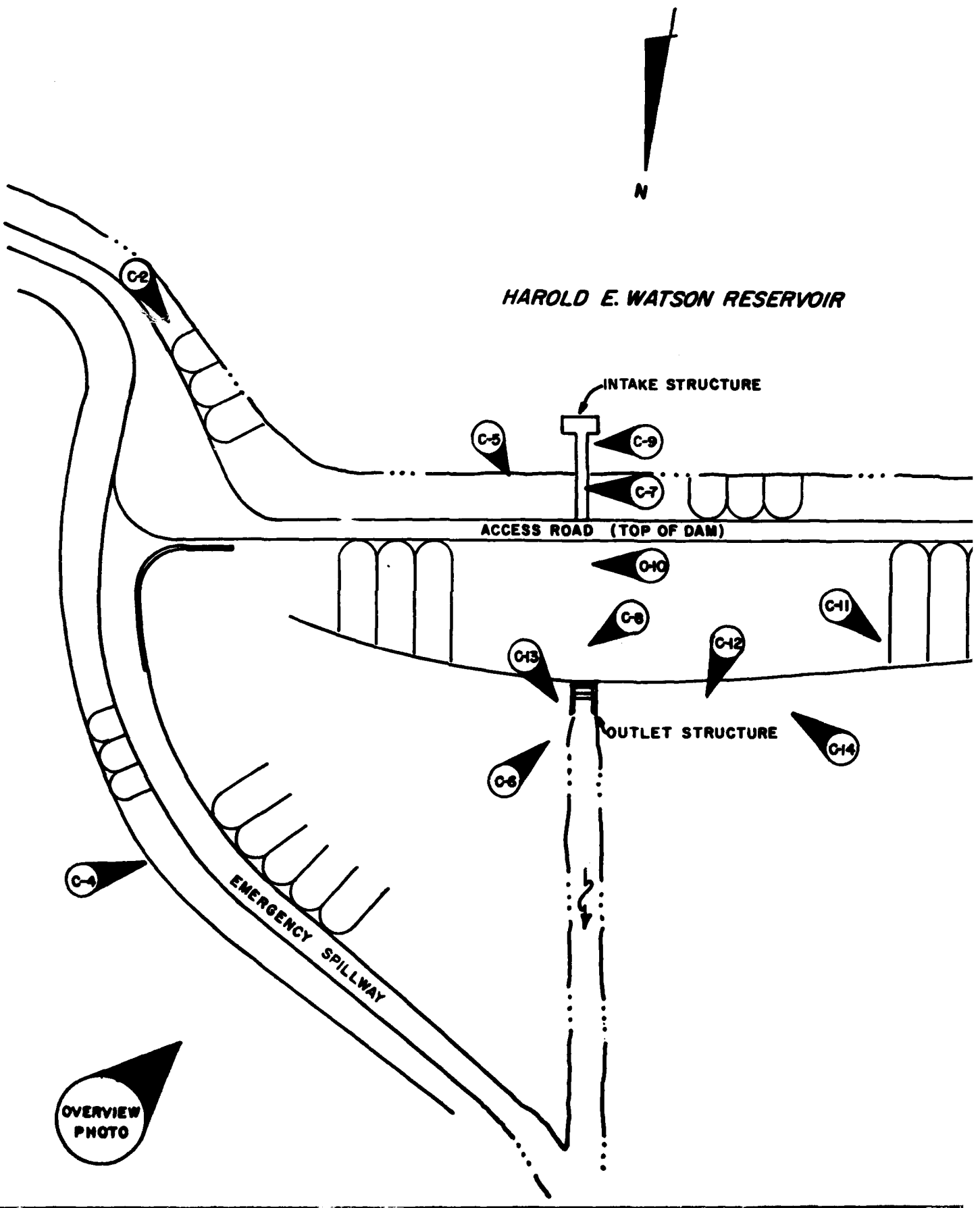
C-2 UPSTREAM SLOPE OF EMBANKMENT-LOOKING FROM RIGHT ABUTMENT AREA

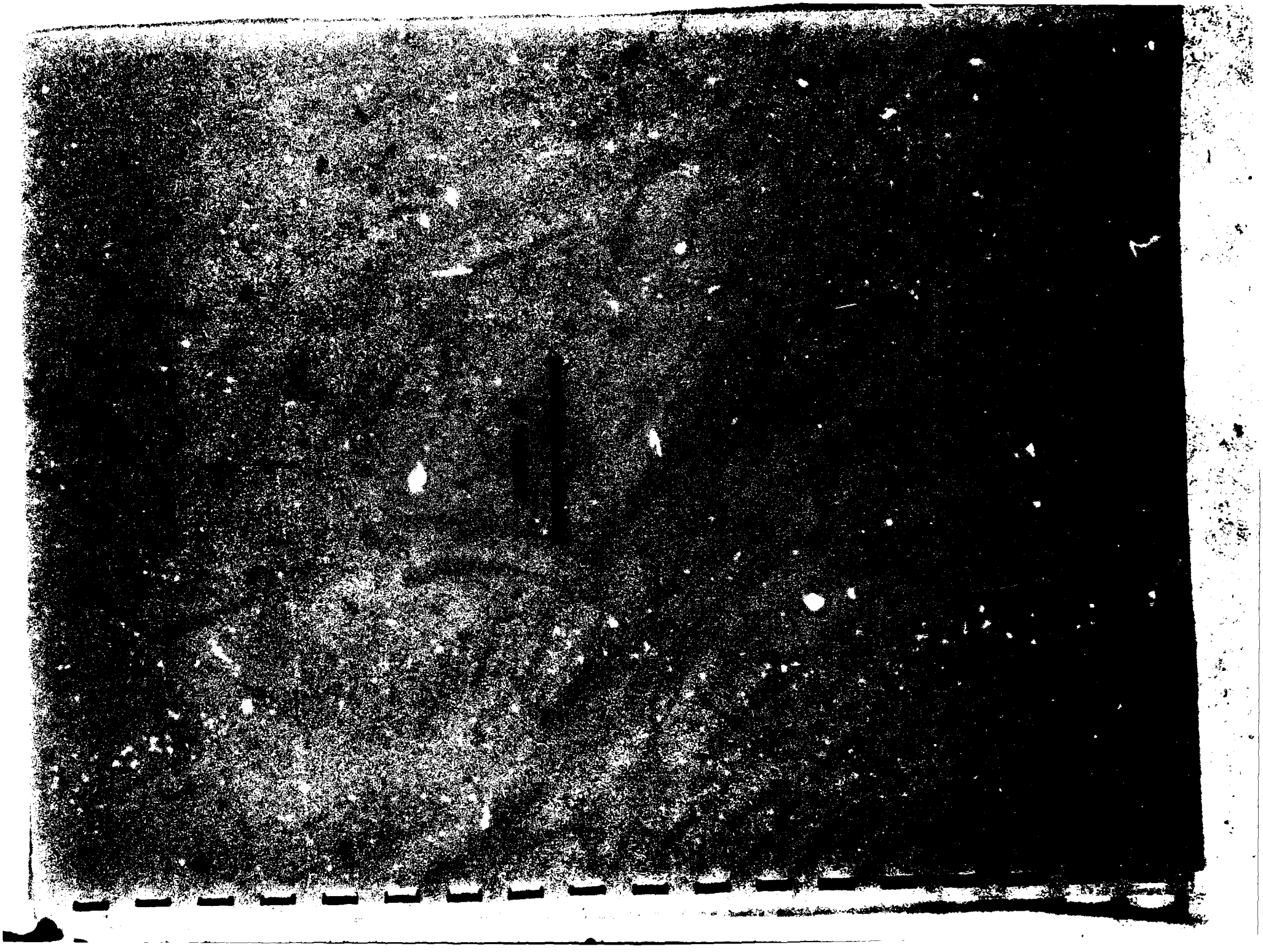


HAROLD E. WATSON RESERVOIR DAM

PHOTO INDEX

2


N
HAROLD E. WATSON RESERVOIR
INTAKE STRUCTURE
C-2
C-5
C-9
C-7
ACCESS ROAD (TOP OF DAM)
C-10
C-8
C-11
C-12
C-13
OUTLET STRUCTURE
C-14
C-6
C-4
EMERGENCY SPILLWAY
OVERVIEW PHOTO



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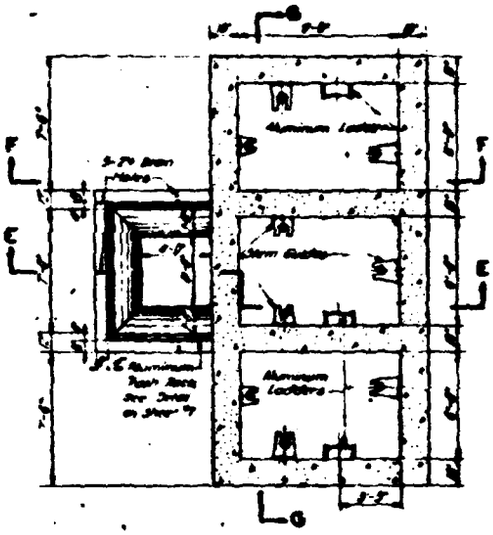
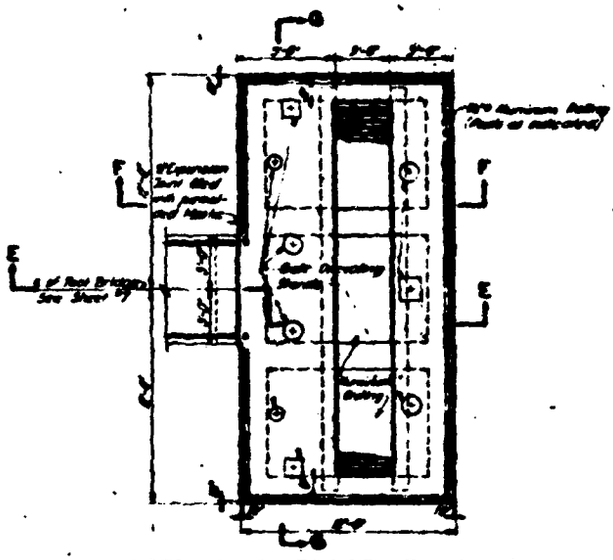
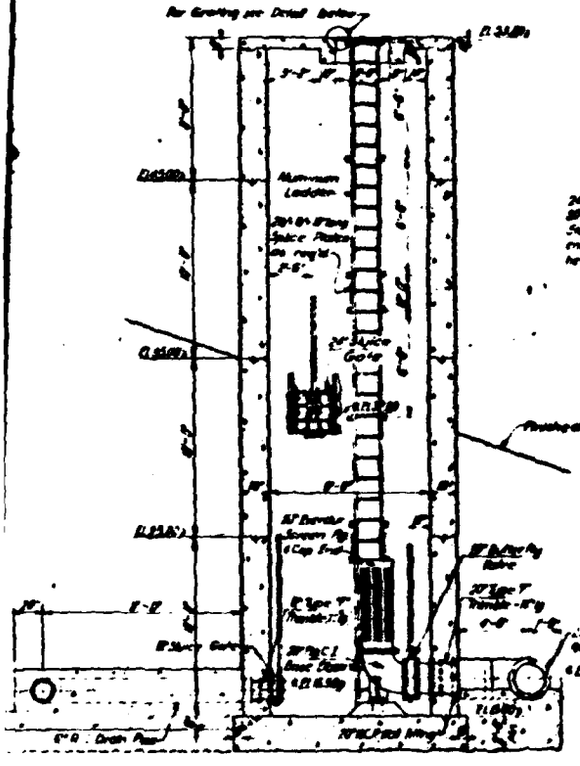


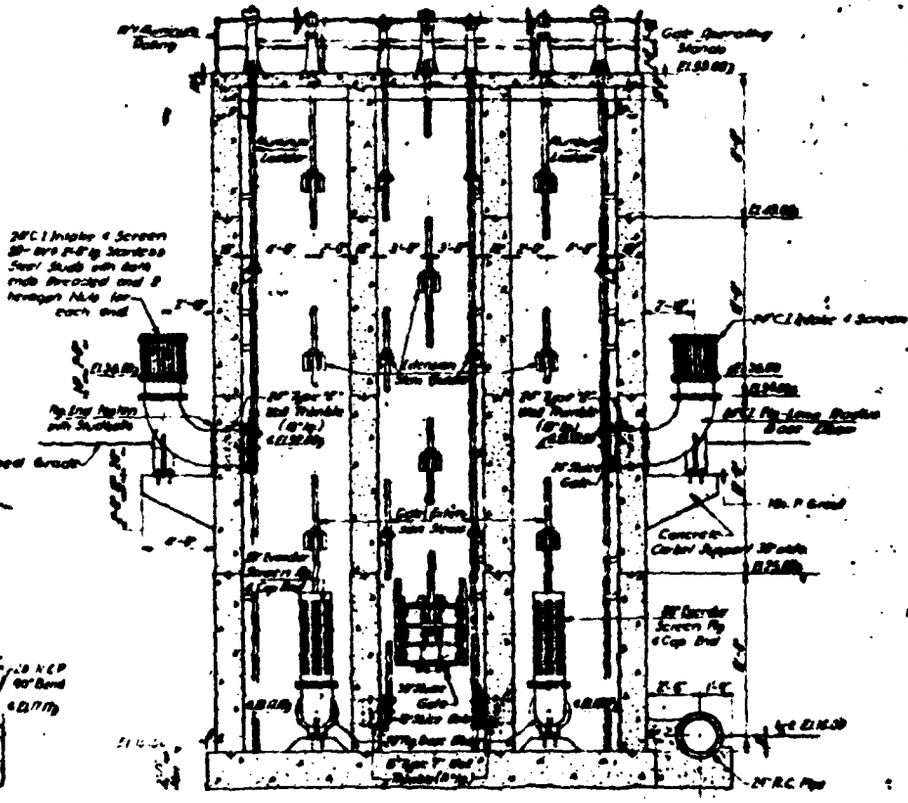
SECTIONAL PLAN AT EL. 46.00



OPERATING FLOOR PLAN



SECTION F - F



SECTION G - G

"AS BUILT"

CITY OF NEWPORT, RHODE ISLAND

NEWPORT WATER WORKS

CONTRACT NO. 4

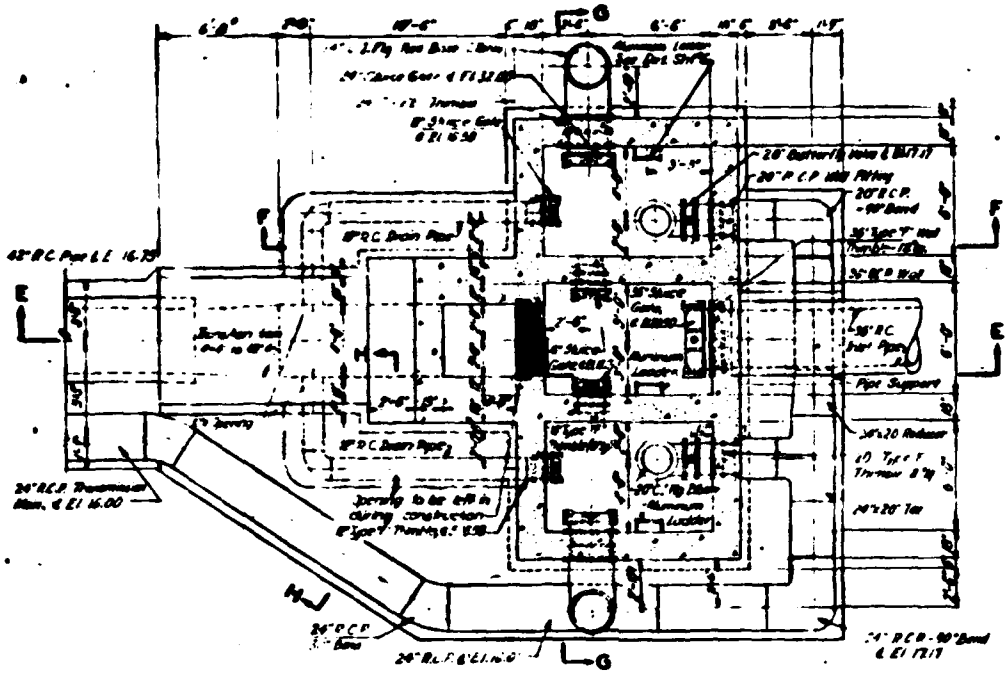
PACHET BROOK DAM

INTAKE STRUCTURE

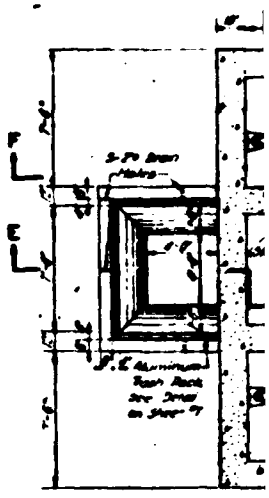
PLANS, SECTIONS & DETAILS

SCALE: 1/4"=1' - 0" EXCEPT AS NOTED

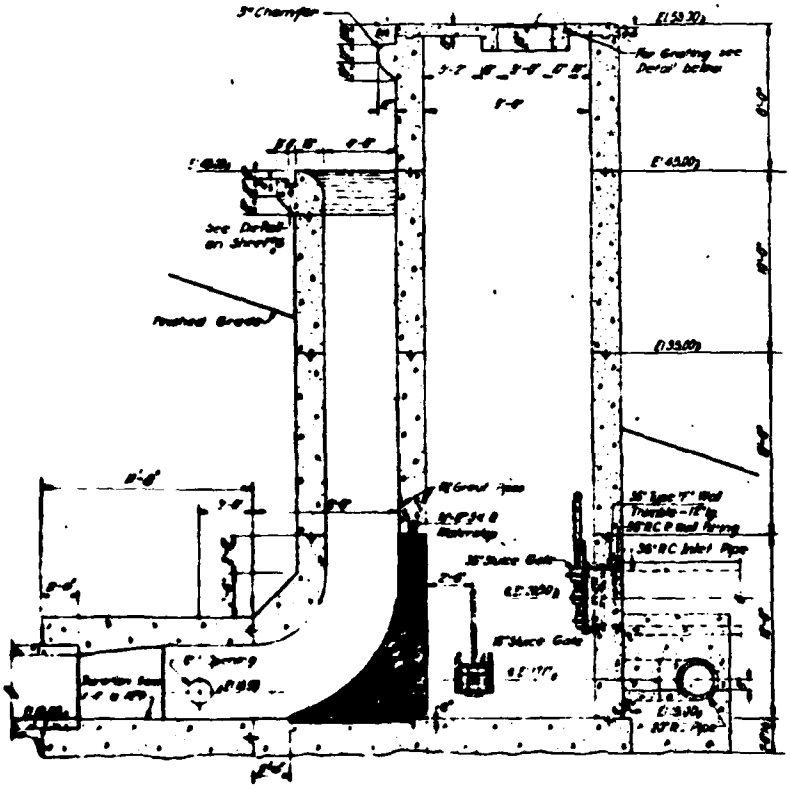
DWG. 178-30.005-0-JAN. 1959-T.P.



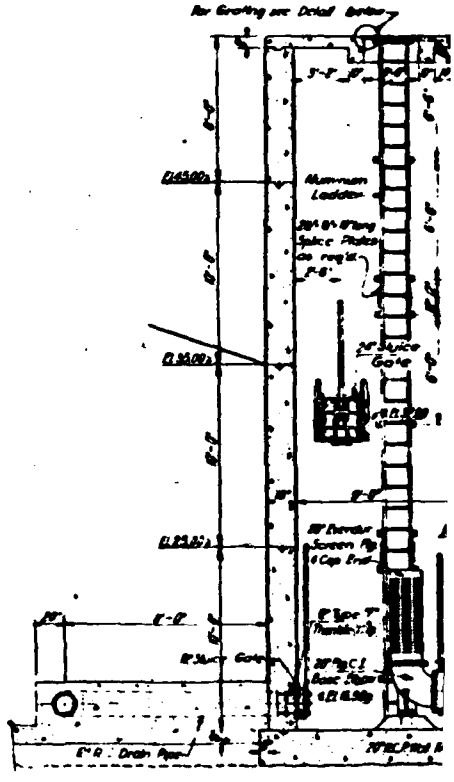
SECTIONAL PLAN AT EL. 35.00



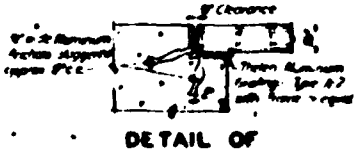
SECTIONAL PL



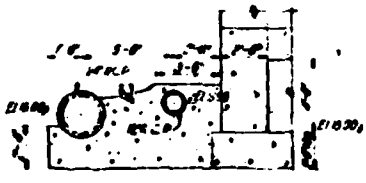
SECTION E - E



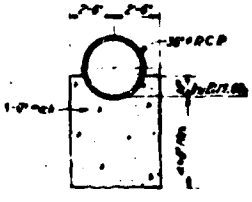
SECTION F - F



DETAIL OF
GRATING WITH FRAME
SCALE 3"-1'-0"

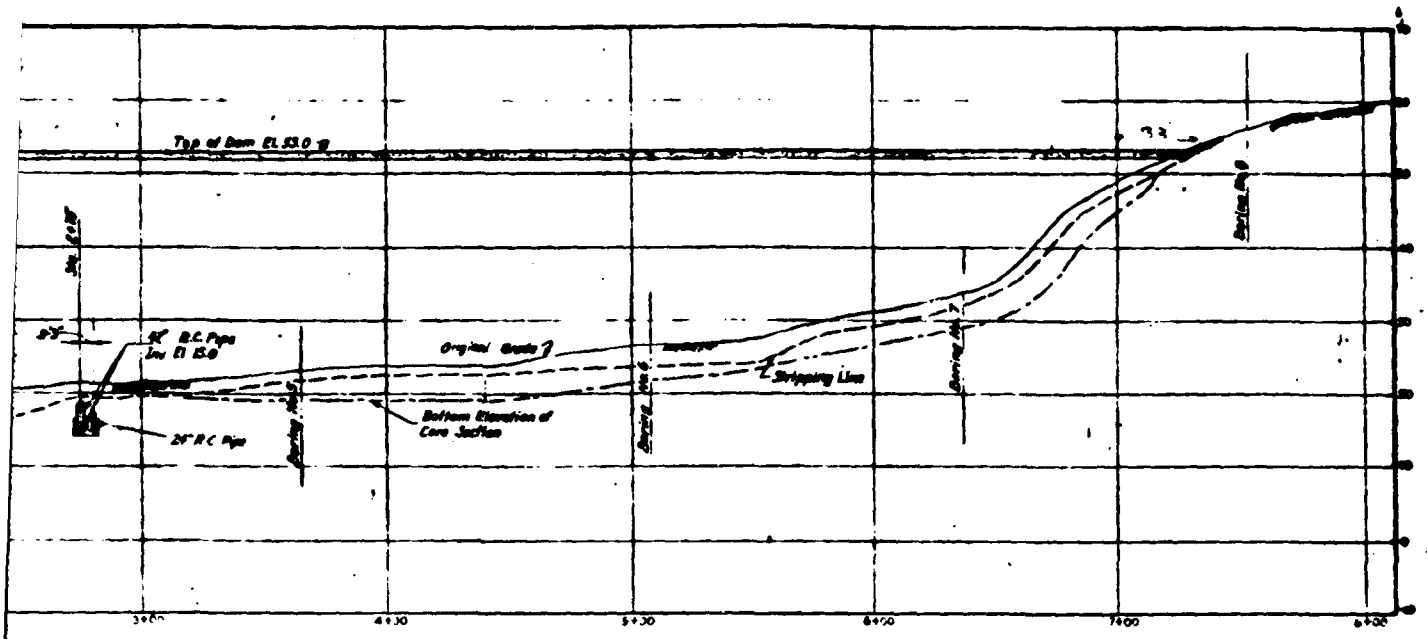


SECTION H - H



DETAIL OF
CONCRETE BLOCK

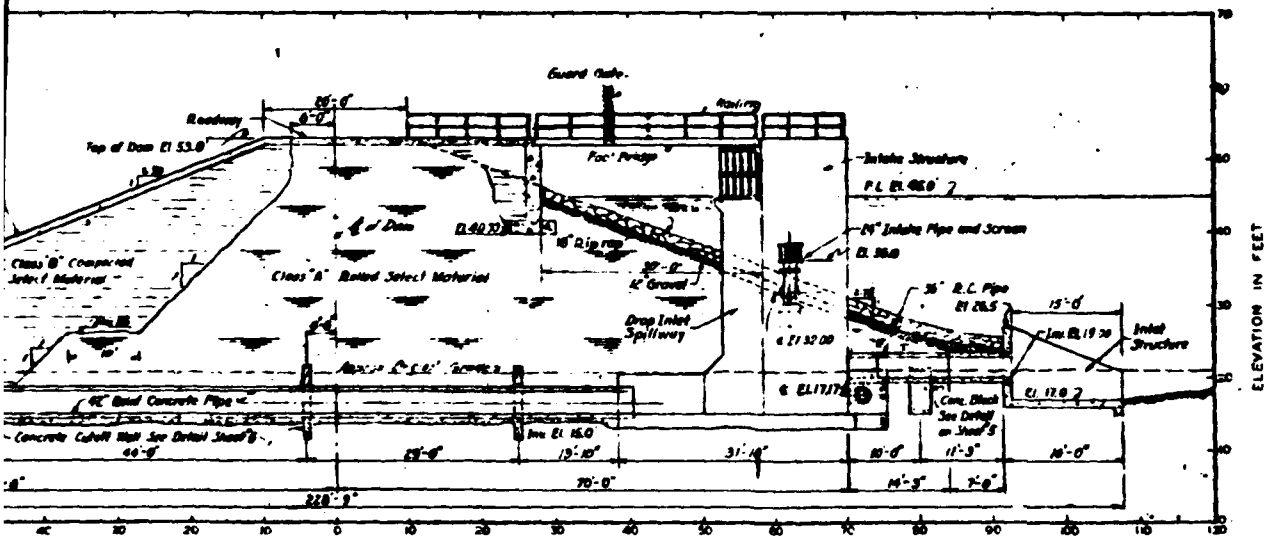
MALCOLM PIRNIE ENGINEERS



DISTANCE IN 100 FOOT STATIONS

CENTER LINE PROFILE OF DAM

SCALES: HORIZ. 1" = 30'
VERT. 1" = 10'



SECTION A-A

SCALE: 1" = 10'

"AS BUILT"

CITY OF NEWPORT, RHODE ISLAND

NEWPORT WATER WORKS

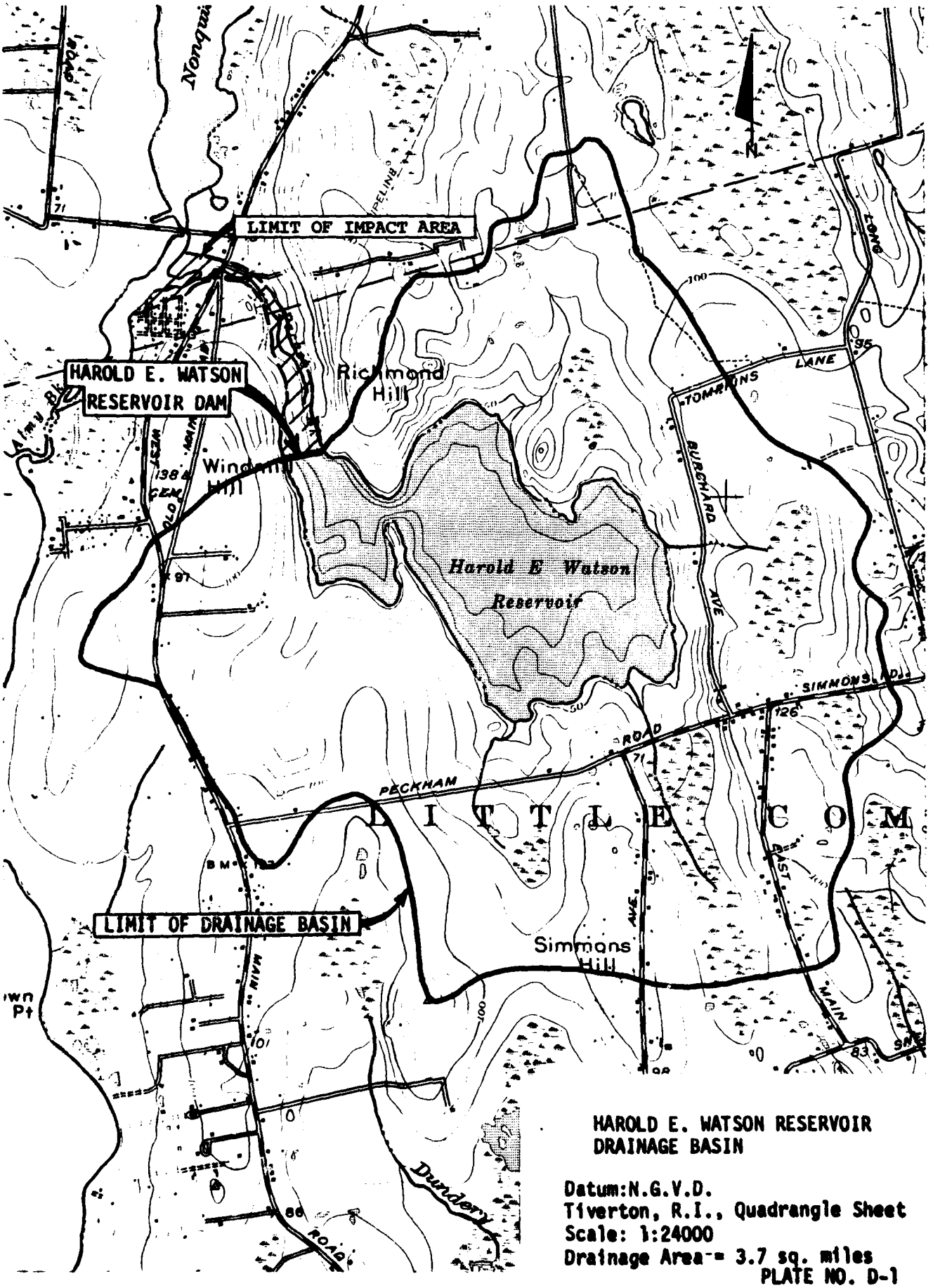
CONTRACT NO. 4

PACHET BROOK DAM

PROFILE & SECTION

SCALES AS NOTED

DWG. 178-S0002-0-JAN. 1950-JB



HAROLD E. WATSON RESERVOIR
DRAINAGE BASIN

Datum:N.G.V.D.
Tiverton, R.I., Quadrangle Sheet
Scale: 1:24000
Drainage Area = 3.7 sq. miles

PLATE NO. D-1

HAROLD E. WATSON RESERVOIR DAM

Dam Failure Analysis

1. Failure discharge with pool at top of dam (elev. 53.0) = 49714 CFS

2. Depth of water in reservoir at time of failure = 36.0 ft.

3. Maximum depth of flow downstream of dam) at time of failure) = 24.0 ft.

4. Water surface elevation just downstream) of dam at time of failure) = 39.0 NGVD

The failure discharge of 49714 CFS will enter PACHET Brook and flow downstream 4000 feet until the brook JOINS NONQUIT POND. There is significant valley storage in this 4000 feet length of brook to reduce the discharge substantially. Also due to roughness characteristics, obstructions and frictional losses, it is very likely that the unsteady dam failure flow will dissipate its wave and kinetic energy and thus convert to steady and uniform flow obeying Manning's formulae 3,000 feet downstream. The failure profile will have the following hydraulic characteristics:

DISTANCE FROM THE DAM	WATER SURFACE ELEVATION NGVD	REMARKS
0 + 00	53.0	Upstream of dam
0 + 00	39.0	Downstream of dam
10 + 00	30.0	
20 + 00	20.0	
30 + 00	15.0	
40 + 00	10.0	JUNCTION WITH POND

Beyond 3000 feet and until the brook joins NONQUIT POND, the failure discharge will flow in the below given channel characteristics:

Q = 40,000 CFS; S = 0.01

n = 0.05; b = 420 FEET; d = 8.0

Side slopes = 1V or 2H.

HAROLD E. WATSON RESERVOIR DAM

A. Size Classification

Height of dam = 36.0 ft.; hence SMALL

Storage capacity at top of dam (elev. 53.0) = 7857 AC-FT.; hence INTERMEDIATE

Adopted size classification INTERMEDIATE

B.i) Hazard Potential

DAM IS LOCATED IN A RURAL AREA NEAR THE COAST. FAILURE OF THE DAM WILL CAUSE APPRECIABLE DAMAGE TO HIGHWAY (WEST MAIN ROAD). FAILURE WILL ALSO DISRUPT THE STANDBY WATER SUPPLY SYSTEM FOR THE CITY OF NEWPORT, RHODE ISLAND.

ii) Impact of Failure of Dam at Maximum Pool (Top of Dam)

It is estimated from the rule of "thumb" failure hydrograph, that the following adverse impacts are a possibility by the failure of this dam.

a)	Loss of life	—	— to —	lives can be lost.
b)	Loss of homes	YES	1 to 10	homes can be lost.
c)	Loss of buildings	YES	1 to 10	buildings can be lost.
d)	Loss of highways or roads	YES	WEST MAIN	road can be damaged.
e)	Loss of bridges	YES	1 to —	bridges can be lost.
f)	Miscellaneous	YES	WATER SUPPLY CAN BE	

The failure profile can affect a distance of 4,000 feet from the dam. For water surface elevation, see next page in Appendix D.

C. Adopted Classifications

HAZARD	SIZE	TEST FLOOD RANGE
SIGNIFICANT	INTERMEDIATE	½ PMF TO PMF

Adopted Test Flood = ½ PMF = 700 CSM

= 2597 CFS

D. Overtopping Potential

Drainage Area 2374.4 ACRES = 3.71 sq. miles

Spillway crest elevation = 45.0 NGVD

Top of Dam Elevation = 53.0 CFS

Maximum spillway drop inlet plus emergency discharge

Capacity without overtopping of dam = 1428 CFS

"test flood" inflow discharge = 2597 CFS

"test flood" outflow discharge = 620 CFS

% of "test flood" overflow carried by spillway without overtopping = 100 %

"test flood" outflow discharge portions which overflows over the dam = 0 CFS

% of test flood which overflows over the dam = 0 %

"Rule of Thumb Guidance for Estimating
Downstream Dam Failure Discharge"

BASIC DATA

Name of dam HAROLD E. WATSON RESERVOIR DAM Name of town LITTLE COMPTON, R.I.

Drainage area = 3.71 sq. mi., Top of dam 53.0 NGVD

Spillway type = DROP INLET - RECTANGULAR - SHARP Crest of spillway 45.0 NGVD

Surface area at crest elevation = 375 ACRES = 0.59 SQ. MI.

Reservoir bottom near dam = 17.0 NGVD

Assumed side slopes of embankments 2H : 1V

Depth of reservoir at dam site 36 FT. = y_8 = 36.0 ft.

Mid-height elevation of dam = 35.0 NGVD

Length of dam at crest = 760 FT.

Length of dam at mid-height = 688 FT.

20% of dam length at mid-height = W_b = 137 FT.

Step 1:

Elevation (NGVD)	Estimated Storage in AC-FT
53.0	7857
50.0	6732
47.0	5607
45.0	4857
43.0	4174
41.0	3498
39.0	2915
37.0	2363

375 AC-FT PER FOOT OF DEPTH

Step 2:

$$Q_{pl} = \frac{8}{27} W_b \quad g \quad y_o^{3/2}$$

$$= 1.68 \; W_b \; y^{3/2} = 49714 \text{ CFS}$$

NOTE: Failure of dam is assumed to be instantaneous when pool reaches top of dam.

Estimating Maximum Probable Discharges - Inflow and Outflow Values Date of Inspection: NOV. 16, 1978

Name of Dam HAROLD E. WATSON RESERVOIR DAM ; Location of Dam PACHET BROOK ; Town LITTLE COMPTON, RI

Watershed Characterization FLAT; SWAMPY UPSTREAM; NEAR COAST ; 0.5 sq. miles of drainage area is swampy or occupied by storage reservoirs

Adopted "test" flood = 1/2 PMF = 700 CSM = 2597 CFS; Re = Effective Rainfall = 9.5 inches

D.A. = Drainage Area (Gross) = 3.71 Square Miles; Basin Slope = 0.01 hence; FLAT SLOPE

S.A. = Surface Area of Reservoir = 0.59 Square Miles; Time of Concentration 60 minutes

Shape and Type of Spillway = 1. DROP INLET - RECTANGULAR - SHARP CREST - OGEE WEIR 2. TRAPEZOIDAL EMERGENCY SPILLWAY

B = Width of Drop Inlet Spillway = 15.0 feet; C = Coefficient of Discharge = (3.8 - Friction) = 3.7 AND DECREASING WITH HEAD.

Maximum Capacity of Drop Inlet Spillway Emergency Without Overstopping = 390 CFS = 63 % of test flood outflow

Maximum Capacity of Emergency Spillway Overstopping = 1038 CFS = 100 % of test flood outflow

Top of Dam Elevation = 53.0 ; Spillway Crest Elevation = 45.0

Overflow portion of Length of Dam = 760 ; C = Coefficient of discharge for Dam = 3.0

Name of Dam	Test Flood Q_p		Inflow Characteristics		Outflow Characteristics First Approximation			Outflow Characteristics Second Approximation			Outflow Characteristics Third Approximation (Adopted)		
	CSM	CFS	h_0 in feet	S_0 in in.	Q_{p1} CFS	h_1 in ft.	S_1 in in.	S_2 in in.	h_2 in ft.	Q_{p2} CFS	S_3 in in.	h_3 in ft.	Q_{p3} CFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14
HAROLD E. WATSON RESERVOIR DAM	PMF = 1400	5194	20.55	39.21	5194	9.06	17.29	17.01	8.91	3412	17.01	8.91	3412
	1/2 PMF = 700	2597	12.95	24.72	620	4.98	9.5	9.5	4.98	620	9.5	4.98	620

Q_p = Discharge; h= Surcharge height; S = Storage in inches

NOTE: Outflow discharge values are computed as per COE guidelines.

HAROLD E. WATSON RESERVOIR DAM

COMPUTATIONS FOR SPILLWAY RATING CURVE

Drop inlet spillway width = 15.0 feet; Spillway crest elevation = 45.0 NGVD

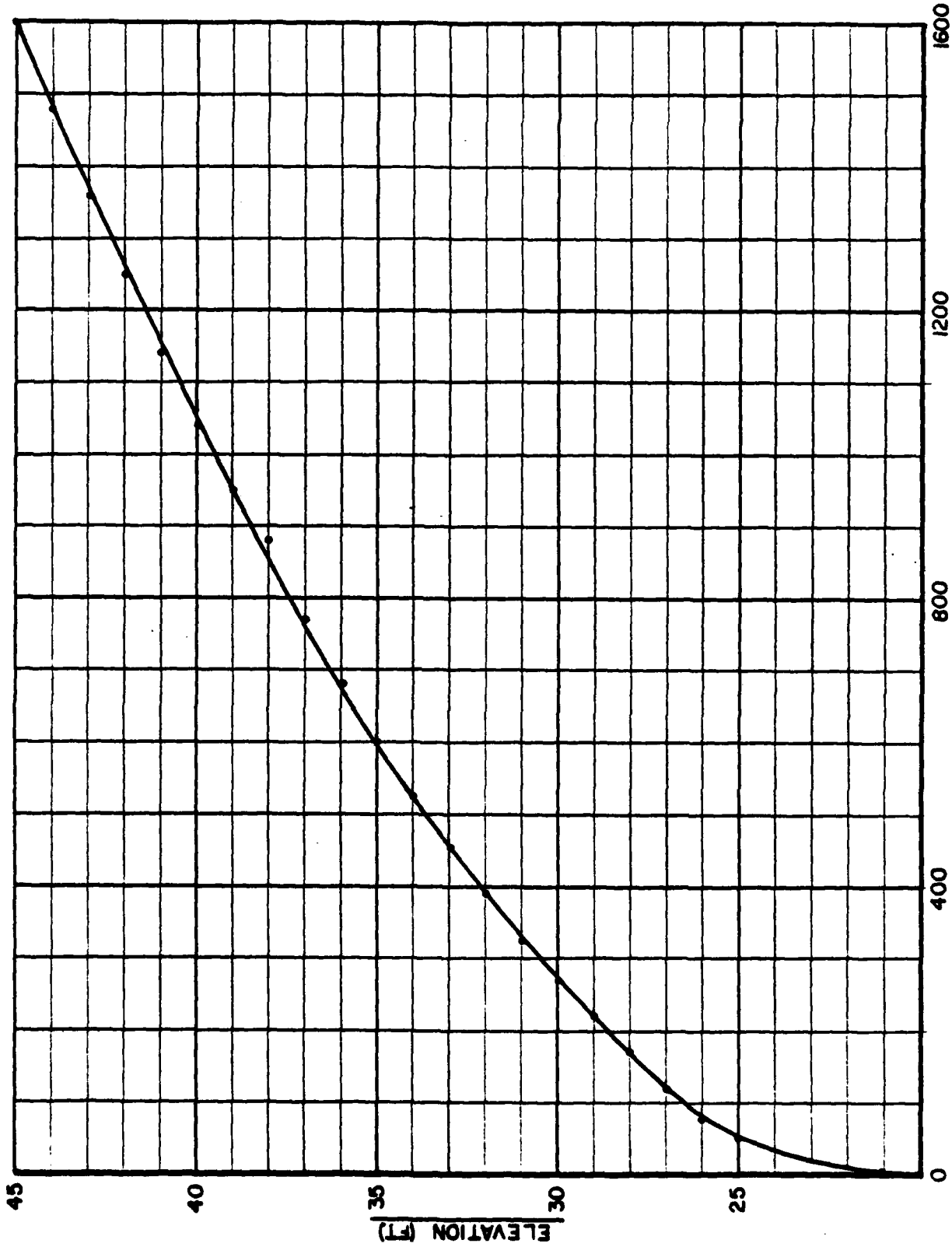
Emergency Spillway width = 20.0 (TRAPEZOIDAL) feet; Spillway crest elevation = 48.51 NGVD

Length of dam = 760 feet; Top of dam elevation = 53.0 NGVD

C = 3.7 DROP INLET AND DECREASING W/ HEAD ; C_d = 0.9 FOR PIPE CONTROL AND ORIFICE

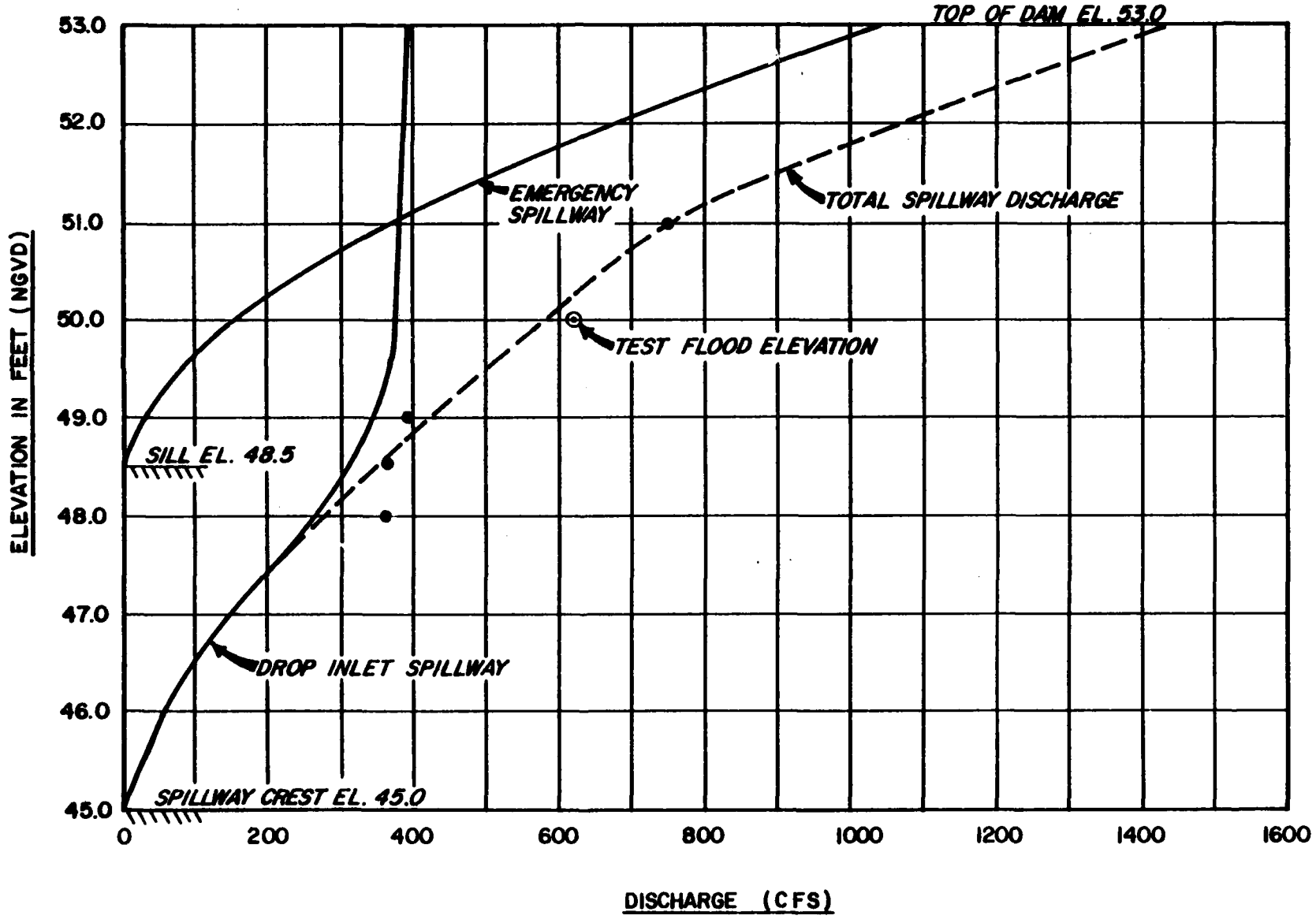
i) SPILLWAY RATING CURVE COMPUTATIONS

Elevation (ft.) NGVD	Spillway Discharge (CFS)		Total Spillway Discharge CFS	Remarks
	Drop Inlet Spillway	Emergency Spillway		
53.0	390	1038	1428	← TOP OF DAM
51.0	379	366	745	
49.0	367	27	394	
48.5	365	0	365	← CREST EMERGENCY SPILLWAY
48.0	362	0	363	
47.0	143	0	143	
46.0	56	0	56	
45.0	0	0	0	← CREST OF DROP INLET SPILLWAY



STORAGE CAPACITY CURVE

H.E. WATSON RESERVOIR DAM
LITTLE COMPTON, RHODE ISLAND



SPILLWAY RATING CURVE

H.E. WATSON RESERVOIR DAM

LITTLE COMPTON, RHODE ISLAND


DATE
FILME